Scientific American

AN ILLUSTRATED

JOURNAL OF ART, SCIENCE & MECHANICS

VOL. LX.

NEW-YORK

PUBLISHED BY MUNN & CO.

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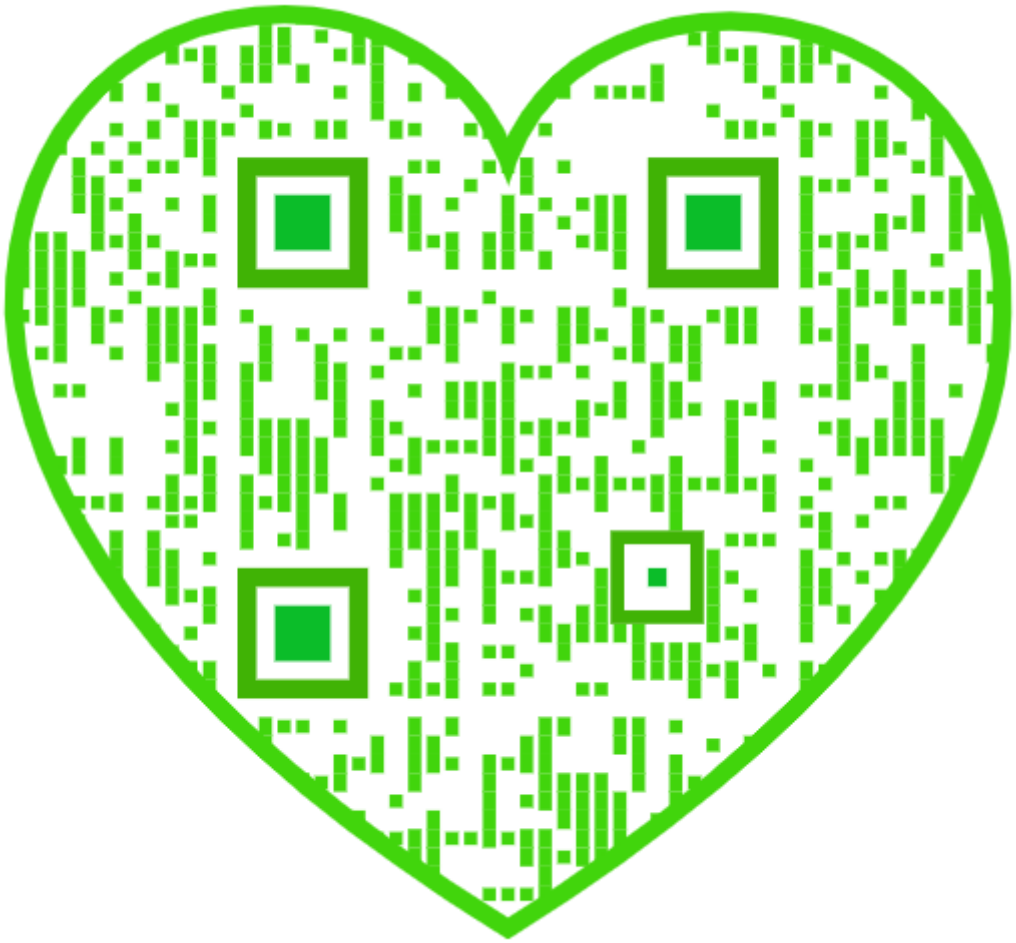

SCIENTIFIC AMERICAN

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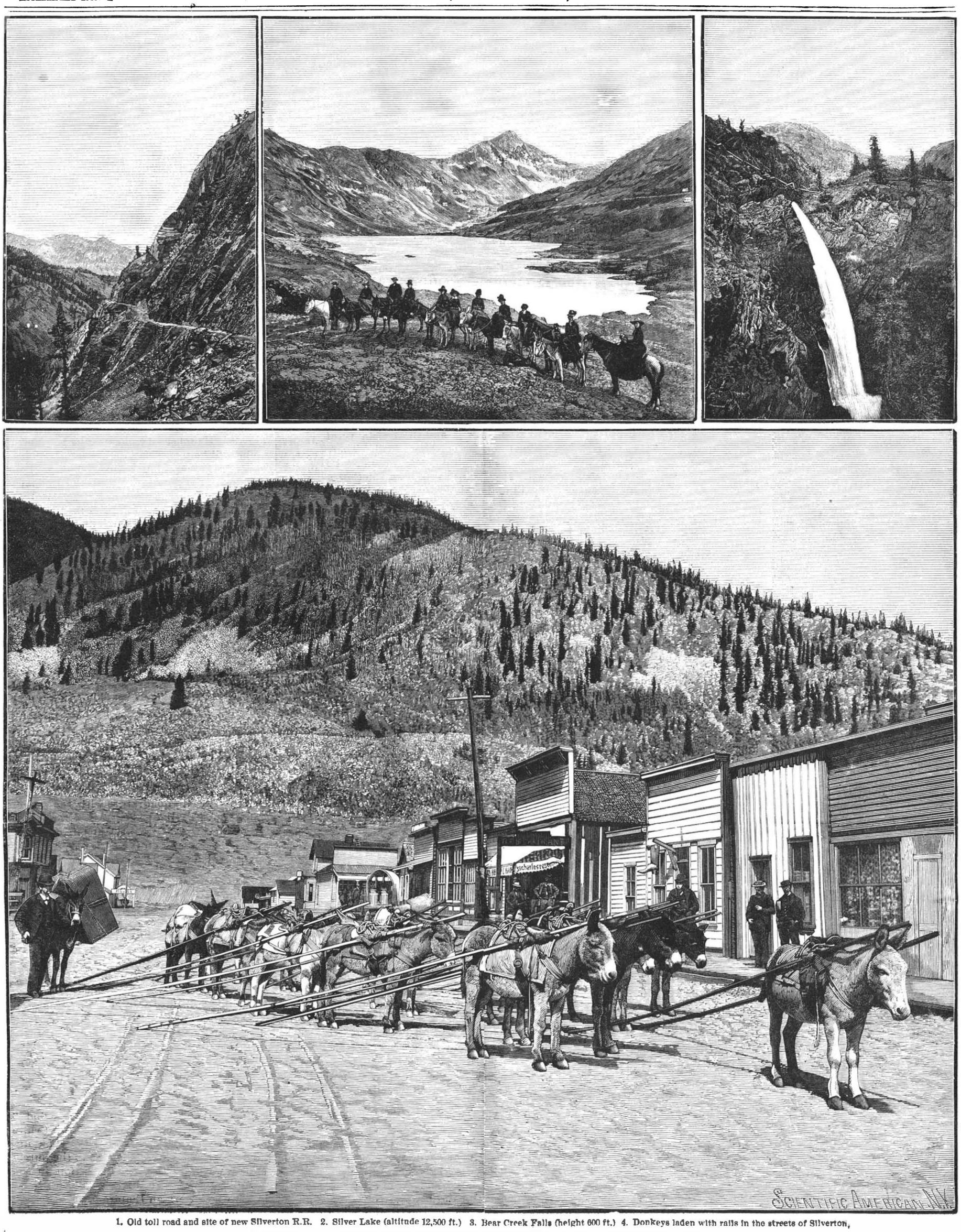
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LX.—No. 1. ESTABLISHED 1845. NEW YORK, JANUARY 5, 1889. $3.00 A YEAR. WEEKLY.



1. Old toll road and site of new Silverton R.R. 2. Silver Lake (altitude 12,500 ft.) 3. Bear Creek Falls (height 600 ft.) 4. Donkeys laden with rails in the streets of Silverton.

NEW RAILROAD OVER THE ROCKY MOUNTAINS OF COLORADO.—[See page 7.]

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Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
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The Scientific American Supplement

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NEW YORK, SATURDAY, JANUARY 5, 1889.

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DEATH BY ELECTRICITY—THE NEW LAW OF NEW YORK.

The new law of the State of New York, ordering death by electricity as the punishment for capital offenses, went into effect January 1st. So radical a change in the administration of the ultimate penalty will probably give rise to delays in the administration of justice. Certain clauses in the constitution will afford the counsel of criminals on trial for murder a pretext for holding the law unconstitutional.

Assuming the constitutionality of the law to be perfect and proved, are the sheriffs and prison officials of the State prepared to inflict the punishment? The very crudeness of hanging brought it within the scope of the commonest type of executioner. But the new method deals with one of the most refined and least understood sciences. Experiments have already been made upon dogs and other animals. A wide variation in personal coefficients of resistance and susceptibility to the current has been found to exist in them. The condition of the skin is the predominating cause of the first variation. A man whose body is warm from exercise and who has a strong perspiratory action will be of lower resistance than when the skin is dry. Again, the effect of the current will vary according to the nervous condition of the subject. This is an element which cannot be included in experiments on the lower animals. A criminal led to execution may be in a state of nervous tension that will very seriously modify the operation of electric shock. A perfect and certain method for the electrical slaying of human beings has not yet been evolved.

Every prison where the law is carried out must be supplied with the most perfect electrical plant. Every connection must be of the best, and all must be kept in perfect order. The effects of disuse, the hardest of all deteriorating causes to combat in their influence upon machinery, must be guarded against. All this apparatus may stand idle from year to year, only to be used on the rare occasions of an execution.

To apply and run the apparatus and to inspect every detail, a skilled electrician will be required. The voltage must be accurately determined, the number of alternations of current per second must be known, if the alternating current is to be used, and the resistance of the person to be killed should be determined. There should be no chance of a failure, and all must be definite and known. It remains to be seen whether a competent person will undertake a duty to which some measure of odium will inevitably attach.

The successor of the present hangman can be depended on to make the fatal contact, but that is all. The electrodes must be attached to the person by or directly under the superintendence of the electrician. The struggles of the prisoner, by disturbing the position of the electrodes, may bring about the most deplorable results. As it is now, far too many executions by hanging fail in the end of quickly killing with little suffering. But where the vastly more complicated mechanism of an electric plant is depended on, the possibilities of a failure are largely multiplied.

Death has been administered to dogs by suffocation in coal gas with perfect success. This death, as far as can be known, is absolutely painless. The writer has several times been rendered totally insensible by inhaling gas, and can testify to the efficacy of the anæsthesia produced. Under its influence a perfectly quiet relapse into unconsciousness ensues, the last memory of events being clear and unclouded. Some such method of inflicting the death penalty would seem far in advance of the electric process. There would be a quick and painless unconsciousness, and the exposure could be so long as to insure a fatal result. It could be applied in an ordinary cell, with no special apparatus, and could even be applied to the criminal while sleeping. It would, above all, be infallible and certain, and would not mar or deface the body. The latter is always liable to happen with electricity.

But the law has been passed and no provision has been made to carry it out. Apparatus is not provided, no competent specialists have been appointed to superintend its administration, and in the present state of affairs, the present law appears to amount to little more than an indefinite suspension of the death penalty for murder.

Elastic Traces.

Every one has noticed that a dray horse is often obliged to use all his weight and strength to start a vehicle which moves along easily enough when once set in motion, and it is quite conceivable that springs in the harness might make the work easier by distributing the movement of starting over a longer period of time. Acting on the suggestion of M. Celler, chief engineer, the directors of the Eastern Railway of France began, six years ago, to harness all the horses employed in shifting freight cars at their Paris station with traces made of chains having a strong spiral spring inserted in them. A large number of horses is employed in this service at the station, and the effect of the change has been very satisfactory. A considerable gain has been made in the durability of the harness and the regularity of the work, through the diminution of the number of chains broken in the service, while the horses have done their work better and with less fatigue. The blow of the collar on the shoulders at starting is far less violent and less injurious to the animal than under the old system, and the horses, finding that a strong continued pressure will effect as much as the jerk which was formerly necessary, seem to gain courage, and pull steadily and directly, instead of wasting their strength in ineffectual plunges. During the six years of trial the directors of the company have become so convinced of the superiority of the new mode of harnessing that it has been adopted in all portions of the vast network of lines under their control.

POSITION OF THE PLANETS IN JANUARY.

VENUS

is evening star and holds the first rank on the planetary annals of the month for her surpassing brilliancy. She is still moving eastward from the sun, and has so increased in size that her diameter, which was 10″ when she became evening star, on July 11, is 20″.6 at the close of the month. Venus and Mars are both in conjunction with the moon on the evening of the 4th, the crescent being south of the planets. The southwestern sky will then present a charming picture soon after sunset. Venus sets on the 1st at 7 h. 56 m. P. M. On the 31st she sets at 9 h. 0 m. P. M. Her diameter on the 1st is 16″.2, and she is in the constellation Capricornus.

MARS

is evening star and ranks next to Venus on account of his close companionship with his peerless rival at the beginning of the month. Observers who have watched the approach of the two planets during December will be specially interested in their conjuction on the 2d, at 7 h. 47 m. A. M. This, of course, is invisible, but on the evening of the 2d Mars will be west of Venus, showing that she has overtaken and passed her ruddy neighbor. Mars sets on the 1st at 8 h. 1 m. P. M. On the 31st he sets at 8 h. 5 m. P. M. His diameter on the 1st is 5″.2, and he is in the constellation Capricornus.

SATURN

is morning star, and holds a prominent place on the January annals. He must be looked for in the northeast, where he will be seen rising on the 1st about half past 7 o'clock in the evening, followed half an hour later by Regulus in the handle of the Sickle. He makes a fine appearance, having nearly reached his brightest phase. Saturn rises on the 1st at 7 h. 37 m. P. M. On the 31st he rises at 5 h. 28 m. P. M. His diameter on the 1st is 18″.8, and he is in the constellation Leo.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 30th, and at that time, and for a week before and after, is visible to the naked eye in the west. He must be looked for three-quarters of an hour after sunset, about 7° north of the sunset point. Mercury sets on the 1st at 4 h. 35 m. P. M. On the 31st he sets at 6 h. 41 m. P. M. His diameter on the 1st is 4″.6, and he is in the constellation Sagittarius.

JUPITER

is morning star, and, before the month closes, will be a conspicuous object in the morning sky, rising in the southeast, more than two hours before the sun. Jupiter rises on the 1st at 6 h. 5 m. A. M. On the 31st he rises at 4 h. 34 m. A. M. His diameter on the 1st is 30″.2, and he is in the constellation Sagittarius.

URANUS

is morning star. He is in quadrature with the sun on his western side on the 11th at 4 h. P. M. Uranus rises on the 1st at 0 h. 58 m. A. M. On the 31st he rises at 11 h. 1 m. P. M. His diameter on the 1st is 3″.6, and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 4 h. 11 m. A. M. On the 31st he sets at 2 h. 11 m. A. M.

Mercury, Venus, Mars, and Neptune are evening stars at the close of the month. Saturn, Uranus, and Jupiter are morning stars.

Illiterates.

A census of the illiterates in the various countries of the world, recently published in the *Statistische Monatschrift*, places the three Sclavic states of Roumania, Servia, and Russia at the head of the list, with about 80 per cent of the population unable to read and write. Of the Latin-speaking races, Spain heads the list with 63 per cent, followed by Italy with 48 per cent, France and Belgium having about 15 per cent. The illiterates in Hungary number 43 per cent, in Austria 39, and in Ireland 21. In England we find 13 per cent, Holland 10 per cent, United States (white population) 8 per cent, and Scotland 7 per cent, unable to read and write. When we come to the purely Teutonic states, we find a marked reduction in the percentage of illiterates. The highest is in Switzerland, 2·5, in the whole German Empire it is 1 per cent; in Sweden, Denmark, Bavaria, Baden, and Wurtemberg there is practically no one who cannot read and write.

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PHOTOGRAPHIC NOTES.

Advantages of the Hydrochinon Developer.—In a series of experiments as to the relative value of the pyro and hydrochinon developers, conducted by W. B. Bolton and described in the *British Journal of Photography*, he finds, in using hydrochinon without any preservative like sulphite of soda, it acts fully as fast as pyro and produces no stain. He dissolved one grain of hydrochinon in one ounce of water. At the end of twenty-four hours it was of a deep brown sherry color bordering on a red or pink tinge, yet perfectly clear and bright. The solution at the end of twelve days was tried on a plate and yielded excellent negatives. He found it particularly useful for undertoned plates, since it gave more body or density to the film without a trace of fog than is the case with pyro. Ammonia was used as the alkali. Regarding its advantages he says:

"As regards quality of image in the sense of freedom from stain, there was, except in two or three of the longest exposures, no chance of comparison between the two developers. With the shortest exposures, even, there was practically no stain with hydrochinon, while the forcing necessary produced in the case of pyro very deep brown coloration, but, of course, as the time of exposure increased, and that of development was curtailed, the staining became less and less, and in the longest exposures the large proportion of bromide used assisted to preserve tolerable purity.

"So far as keeping the film clear from stain is concerned, I am free to admit that these experiments were not conducted as the actual development of so many negatives would, perhaps, have been, *i. e.*, with the addition of sulphite. But it must be borne in mind that the charge brought against hydrochinon was that, while much slower than pyro, it possessed no advantage over the latter in cleanness. The proper course then was to try them on their merits, and this I endeavored to do, giving pyro, if anything, the advantage. The result shows that hydrocoinon is, under the circumstances, quite as rapid as pyro and much cleaner; and I think it will scarcely be claimed by anybody that if sulphite had been used to keep the pyro clean, its rapidity would have been increased.

"It is impossible, fairly, to compare two developers under precisely identical conditions, as in this case, at least, 'What is sauce for the goose is not sauce for the gander.' To wit, I maintain that though bromide and sulphite are advantages and benefits to pyro, they are unnecessary and a drag in the case of hydrochinon. I hold, in fact, that the proper use of hydrochinon lies in employing it, under normal circumstances, at least, without any such adventitious aids or hindrances; or if it be necessary to preserve for lengthened periods in solution, to use a minimum of nitric or citric acid as the preservative in place of sulphite."

Hydrochinon Developer.—According to the *Photo. News*, M. Balagny, of Paris, France, prefers the following as an excellent developer for instantaneous exposures:

Water	10 ozs.
Sulphite of soda (crystals)	6 drms.
Hydrochinon	50 grs.
Carbonate of soda in crystals	1½ ozs.

The hydrochinon must be completely dissolved before the carbonate of soda is added; if any little grains are left undissolved, the addition of the alkali will cause the solution to be at first reddened, and later on rendered unserviceable.

For ordinary exposures a mixture of equal proportions of a new and old developer is advised. In copying engravings and other work of a similar character, an old developer only should be employed.

To convert a new developer so that it will have the effect of an old one, add to each three ounces 20 drops of glacial acetic acid, to which mixture 3 ounces of water may or may not be added. A fresh bath will develop five or six instantaneous exposed plates in succession. A great point in favor of hydrochinon is the latitude of exposure which is permissible without any alteration of the developer. Plates exposed varying from two to twelve seconds all came out equally well. Balagny advises the use of glass or porcelain trays, finding that the black or rubber trays in common use are liable to discolor the solution.

Photographic Congress.—An international congress, to be under the especial management of the French Photographic Society, is expected to be held in Paris during the summer of 1889, having in view mainly the securing of uniformity of several things pertaining to photography, among them being the fixing of a standard light, standard sizes and threads of lens mounts, and methods of determining in some uniform way the sensitiveness of commercial plates.

Permanency of Bromide Prints.—In developing bromide paper with the ferrous oxalate developer, it has come to be the practice, after the developer has been poured off, to immediately flow over the print a dilute solution of acetic acid and water, which dissolves any iron salts remaining in the film and produces clear whites. The *British Journal of Photography* states there is danger in not sufficiently eliminating the acid effect prior to fixing the print in hyposulphite of soda. This, it recommends, should be avoided by more careful or prolonged washing in water. Then it should be put into a fresh bath of hyposulphite of soda and left there for ten minutes, and perhaps put into a second hypo. bath, and lastly well washed. By this means all of the silver will be converted into a soluble salt, readily removed by soaking in water. If the print is put in the hypo. too soon, sulphurous acid, sulphur, and other deleterious matters are set free in the paper. After a while, when the print is exposed to the light, the paper itself will turn slightly yellow, while the image on its surface remains unchanged.

Items from the Report of the Secretary of War.

MILITARY EXAMINATIONS.

It should be borne in mind that it has been and still is the policy of the government to rear and train at West Point young men from all portions of the Republic to be soldiers. No expense is spared to give them the best military education possible. Only those who succeed in passing the tests of rigid examinations are selected for the public service. So severe is the ordeal through which they pass, that but one in three succeeds in graduating, Nor is expense spared in providing for these young men thus educated when they take their places in the army, for the pay of our officers is higher through all its grades than that of any other army save the Anglo-Indian army. And yet, after thus preparing and providing for them, there are no special requirements, common to all, demanding their progress and growth in the profession of arms; and no inquiry is made, or examination had, as the years go by, and they advance, grade after grade, whether as individuals they are worthy of promotion, and are equal to the higher rank and larger responsibilities they are forced to assume. When a second lieutenant enters the service, whether from civil life, the ranks of the army, or from the Military Academy at West Point, the rigid examination above alluded to is made the necessary condition for the commission. But this once passed, under present regulations, the officer can, and but too frequently does, close his books and his studies; and if he does not overwork or expose himself, he knows that, with good health and life, he is certain, under the operation of compulsory retirement, to reach the highest grade open to seniority in his arm of the service.

I assume it to be true in the army, as elsewhere, that no man should occupy a position for which he is not fitted; and it is equally true that there should be some way in the army, as elsewhere, through which such fitness should be ascertained. It should be a professional examination, having reference to the mental, moral, and physical fitness of the candidate. Its object is plain—the advancement and elevation of the service. Surely there can be no reasonable objection to this test on the part of those who will be subjected to it.

Soldiers are developed and matured rapidly on the battle field, but in time of peace it is only by study and application, by practical experiment, by exercise in the use of weapons, and by keeping fully abreast of the world's knowledge, that the soldier can be made ready for his real work, when it comes.

I would therefore suggest for the consideration of Congress that a general law be enacted, with provisions respecting examination similar to those which govern promotion in the navy, with such changes and limitations, in regard to the number of examinations, and to what grades of rank and to what arms of the service they shall be extended, as may be considered necessary in applying the law to the army.

COLLEGE MILITARY INSTRUCTION.

The reports from colleges where army officers are serving as instructors show that effort is made to instruct the students in practical rifle firing, but that the annual allowance of ammunition for this purpose is entirely inadequate. By a generous supply of ammunition to these colleges for target practice it is possible that competitive contests in rifle shooting might, in time, become as popular with some of these inland colleges as boat racing now is at the universities of our seaboard.

THE POTOMAC FLATS.

In execution of the plan projected for this improvement, there has been dredged a channel from 350 to 550 feet wide and 20 feet deep, between Georgetown and Giesboro Point. The Washington channel has been dredged to a width of 350 feet and 20 feet deep, all the material being deposited on the flats, and up to the present time about 544 acres have been reclaimed from the overflow of ordinary high tide. Of the 12,000,000 cubic yards required to raise the flats to the proposed height of three feet above the highest freshets, about 6,511,000 have been deposited. On June 30, 1888, the expenditure for this improvement amounted to $1,247,495—less than half the estimated cost of the work.

SMALL CALIBER ARMS.

The investigations have been completed to determine the charge and projectile, rifling, chamber, etc., for an arm of smaller caliber than the present service piece. It is the intention to use compressed and perforated cartridges, but as yet the powder makers have not succeeded in producing a satisfactory powder, the desired velocity being accompanied by too great a pressure. This matter of a suitable powder is still under study and trial. The results obtained in France with the Lebel rifle seem to point to a radical change in the manufacture of powder for small arms.

THE 8-INCH BREECH LOADER.

The firing of the 8-inch breech-loading gun has been continued during the past year as rapidly as suitable powders could be procured and as other important work would permit. Much delay has occurred from the failure of the powder makers to reproduce or duplicate powders accepted as satisfactory. The gun has been fired 203 rounds, and is in sound and serviceable condition. This firing has produced light but distinctly visible erosion marks on the front slope of the powder chamber, the shot chamber, and the bottom of the rifled bore. The firing will be continued until the endurance is thoroughly tested. Experience indicates that the erosion increases rapidly as the pressures increase, and the pressures during the test of this 8-inch gun have averaged over 16 tons, and reached as high as 22 tons, per square inch of powder chamber. The gun is in the hands of the board for testing rifled cannon and projectiles, and its report will be rendered during the coming year.

CAST IRON BREECH-LOADING MORTARS.

The 12-inch breech-loading rifled mortar, cast iron, hooped with steel, has been subjected to preliminary firing by the Ordnance Board, with the object of determining suitable kinds and weights of charge, to cover all ranges from 1 to 6 miles, without exceeding the prescribed limit of pressure, and to ascertain the best form of banding for the projectiles. This firing is not completed, and the results thus far obtained can hardly be accepted as the best to be expected from this piece. In all, about 193 rounds were fired, of which 78 rounds were with charges of from 50 to 80 pounds, with an average pressure of about 28,000 pounds, but reaching as high as 33,000 pounds per square inch. The maximum charge is not less than 80 pounds brown prismatic powder; density of loading, 1·113; weight of shell, 630 pounds; maximum velocity, 1,152 feet; energy, 5,796 foot tons. The range attained with this charge and weight of shell under an angle of 45 degrees was 10,480 yards, or 5·95 miles.

It is the intention to subject the mortar to a fire of endurance of not less than 400 rounds, of which 200 shall be with the maximum charge or in which the pressure shall be a maximum. It is the intention to use a stronger powder for the maximum charge, to give a pressure of about 30,000 pounds, with a velocity of about 1,175 feet. The present mounting of the mortar, as regards both carriage and platform, is unsatisfactory, and the firings for accuracy at long range will have to be postponed until a new platform can be laid. No firings for rapidity have as yet been made, and at this date it may be said that the accuracy of fire, endurance, and power are not definitely determined except as to the minimum limit.

CAST IRON RIFLES.

The manufacture of the two 12-inch breech-loading rifles, cast iron tubed, and cast iron hooped and tubed, after having been suspended for nearly two years, owing to the failure of the contractors to complete them within the lifetime of the appropriation, was resumed this spring, Congress having reappropriated the money to pay for them, and having also extended the contracts. The 12-inch breech-loading rifle, cast iron hooped and tubed, has been completed and sent to the proving ground; the other gun, the 12-inch breech-loading rifle, cast iron tubed, will probably be completed by next December.

PNEUMATIC DYNAMITE GUNS.

Under the provisions of the army bill for the procurement of pneumatic dynamite guns, the necessary specifications are now being prepared, and advertisements for proposals will issue early in December. The guns will probably be of 15 inches caliber and throw a projectile that will carry a charge, each, of about 500 pounds of explosive gelatine, with full caliber projectiles. The guns will probably be delivered in from six to ten months from the date of the contract, so that all the guns of this class that can be procured under the provisions of the law will be purchased during the coming year 1889.

Bichloride of Mercury as a Preventive for Cholera.

During his recent residence in Tonquin, M. A. Yvert successfully employed this preparation for the cure of cholera in doses varying from 0·02 to 0·04 grain in twenty-four hours. Of forty-five patients so treated nine only succumbed, or about 20 per 100, the normal rate in that region as in Europe being 66 per 100. It was also administered to convalescents in districts where the epidemic had again broken out and had already made one victim. None of those who took this preventive medicine was attacked.

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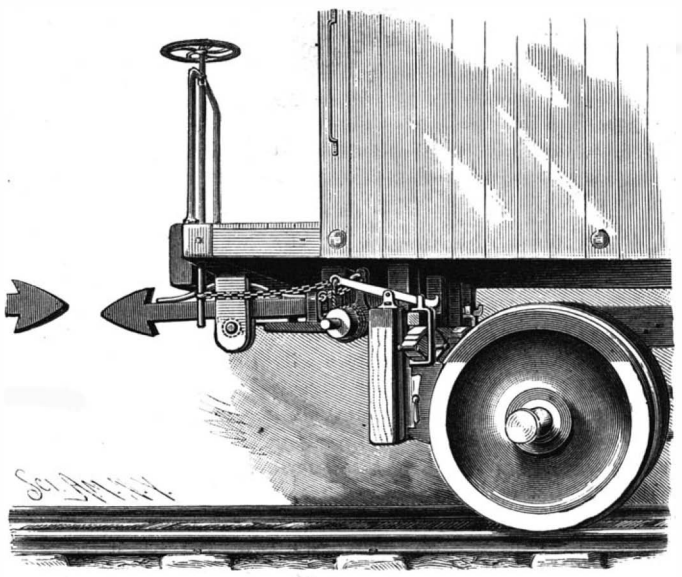
AN IMPROVED CAR BRAKE AND COUPLER.

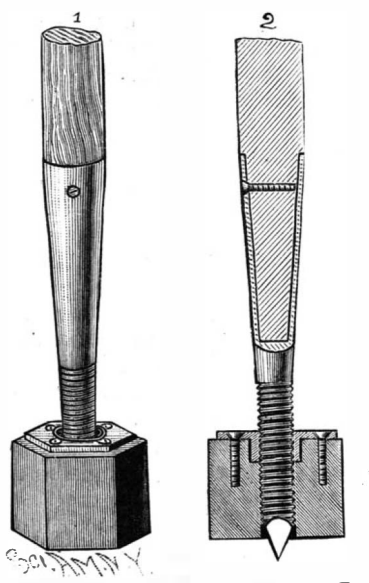
An improvement in car brakes, whereby the brake will be automatically applied in case of a collision, and an improvement in couplings, whereby two opposing cars may be united without the operator passing between the cars, and wherein the cars will couple whether the approaching link passes beneath or over the opposing link, are illustrated herewith, and form the subject of two patents granted to Mr. James Mutton, of Frisco, Utah Ter. A transverse beam projects vertically downward at the rear of the drawbar and in front of the axle, short bars being secured to the floor beams at the rear of this beam, while from the short bars a rectangular strap yoke is loosely suspended, having secured to its under side a brake shoe, these shoes being normally held in contact with the wheels by means of an elliptical spring. When the cars are coupled and drawn ahead, the brake shoes are raised, but with the stoppage of draught on the drawbar the springs act to apply the brakes. In backing, the brake is reversed by means of a suitable brake shaft. In the car coupler, two sets of opposing blocks are secured to the sills on the under surface of the car, there being downwardly extending arms from the forward blocks. A friction roller is journaled in these arms, a link reciprocating between the forward blocks, bearing upon the roller, and having an arrow-like head, while a transverse guide plate is attached to the inner end of the link, reciprocating in the space between the forward and rear blocks. A spring is secured to the upper surface of the link having a bearing against the under surface of the car.



MUTTON'S CAR BRAKE AND COUPLER.

AN IMPROVED CRUTCH ATTACHMENT.

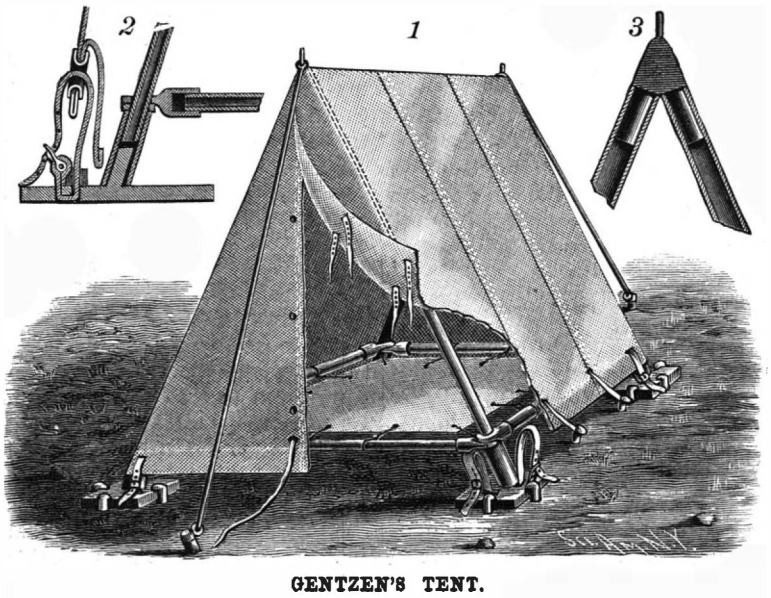
A crutch having an elastic foot and a spur, either of which may be adjusted for use alone, as required, is illustrated herewith, and has been patented by Dr. William J. Donald, of Tunnel City, Wis. The socket piece fitting the lower end of the crutch is made with a screw-threaded projection having a pointed end, which serves as the spur for the crutch, to be used for slippery surfaces. Upon this projection is mounted an elastic buffer or foot, a screw-threaded lug in which engages the screw-threaded projection, by which the buffer is adjustable up or down on the projection. The buffer is preferably formed with a number of sides, so that it will not have to be handled in interchanging it for use with the spur, this being done by simply rolling the foot end upon the ground or floor to screw or unscrew the buffer on the projection, thereby projecting or withdrawing the spur.



DONALD'S CRUTCH ATTACHMENT.

AN IMPROVED TENT.

The accompanying illustration represents a tent for the use of soldiers or civilians, which can be easily and quickly pitched or struck. It has been patented by Mr. Herman Gentzen, of Fort Ringgold, Texas. The main frame of the tent consists of a pair of downwardly and laterally diverging poles at each end of the tent, anchored in foot plates or blocks at the corners, and a horizontal frame of four bars supported on the poles, and giving support to a stretched bed bottom fabric. The pairs of poles are connected by a peak block at each end of the tent, as shown in Fig. 3, and a ridge pole may also be used if desired, stakes or pins, and stay cords, being also used at the sides and ends of the tent. Fig. 2 is a vertical sectional view of the frame, canvas, and anchor straps at one corner of the tent. By this construction the occupants of the tent, resting on the bed bottom fabric, help to keep the tent well anchored, while they are supported clear above the ground, and not subject to the inconveniences consequent upon sleeping on the earth.



GENTZEN'S TENT.

Sifting the Sands for Valuables.

A midsummer tide of humanity flowed against the hotel bulwarks at Atlantic City. The ruin-strewed beach was full of sightseers. There was a curious coincidence connected with the trip of one of the yachts. The party was carried by Captain Will Gale in his yacht Alert. They spoke a trim-looking schooner off shore, and the captain inquired after the people in Atlantic City. In the conversation that followed it was found that the schooner was no other than the Robert Morgan, which was blown high and dry on shore during the terrific storm of 1884, and upon which balls and parties were held all of the following season.

A small army of sand sifters were at work on the beach. Their outfit consisted of a sieve, a shovel, and a tin box. They dug the sand from around the posts on which the board walk had been laid. After reaching a depth of about two feet, the sifters ran the sand through their sieve. Frequently their efforts were rewarded by finds of precious stones and jewelry.

To a curious visitor one of the sifters exhibited his treasure. It comprised diamond pins, a plain gold ring, a dollar gold piece, and a number of smaller coins. He had made a lucky hit in the morning, and was about $150 better off. He said there were cases where $500 had been recovered from the sand in a day, but that many days were often spent without recovering a dollar's worth. The action of the sea washes all particles around the posts along the beach, and the hundreds of dollars' worth of jewelry and money lost by the summer crowds are gathered in by these patient toilers during the cold months.—*Philadelphia Record.*

Vocal Music as a Preventive of Phthisis.

A suggestive paper by Dr. C. E. Busey, of Lynchburg, was lately read before the Medical Society of Virginia. He stated as a well known fact that those nations which were given to the cultivation of vocal music were strong, vigorous races, with broad, expansive chests. If an hour was daily devoted in our public schools to the development of vocal music, there would not be the sad spectacle of the drooping, withered, hollow-chested, round-shouldered children. There was too great a tendency to sacrifice physical health upon the altar of learning. Vocal music was a gymnastic exercise of the lungs by development of the lung tissue itself. The lungs in improved breeds of cattle, which naturally took little exercise and were domiciled much of the time, were considerably reduced in size when compared with those of animals running at liberty; and so it was with the human race, which led inactive lives from civilization.

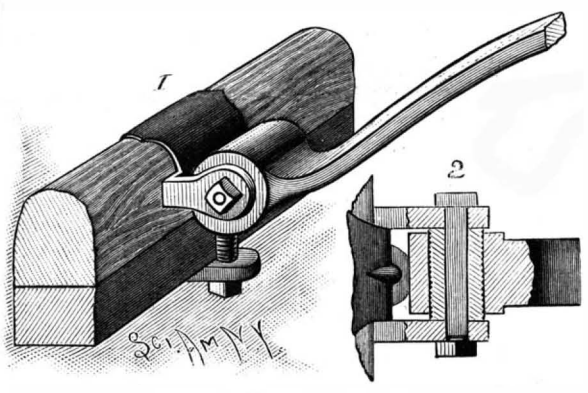
Phthisis generally began at the apices of the lungs, because these parts were more inactive, and because the bronchial tubes were so arranged that they carried the inspired air with greater facility to the bases than to the apices. During inactivity a person would ordinarily breathe about 480 cubic inches of air in a minute. If he walked at the rate of six miles an hour, he would breathe 3,260 cubic inches. In singing, this increased more than in walking, as to sing well required all the capacity of the lungs. The instructor of vocal music, in addition to his musical education, should understand the anatomy and physiology of the respiratory organs.—*N. Y. Med. Jour.*

A Large Wood Pulp Mill.

John A. Greenleaf, of Lewiston, Me., has closed a contract with the Shawmut Fiber Company for the erection of the largest pulp mill in the United States, if not in the world. It is to be built at Somerset Mills, Me., and Ex-Gov. A. H. Rice, of Mass., is one of the projectors of the enterprise. The buildings will be nine in number, as follows: A woodworking room, 41 by 50 feet; a digester house, 50 by 64 feet; two tank houses, each 62 by 16 feet; two machine houses, 54 by 52 feet and 50 by 50 feet respectively; an acid house, 50 by 50 feet; a sulphur-burning house, 52 by 28 feet; a sulphur storehouse, 27 by 27 feet. These buildings will take over 300,000 feet of lumber, over 200,000 shingles, 12,000 clapboards, and about 350 ship's knees.

AN IMPROVED THILL COUPLING.

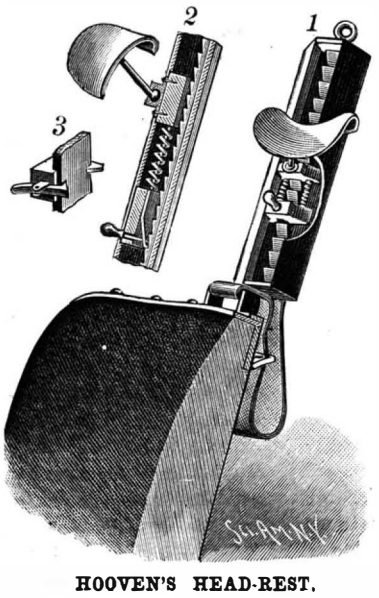
A readily adjustable thill coupling, constructed for durability and to avoid rattling, is illustrated herewith, and has been patented by Mr. Miner N. Loehr, of Warsaw, Ind. The thill iron is connected to the axle clip by means of a screw-threaded bushing screwed into the socket end of the thill iron, the ends of the bushing projecting from the socket and bearing against the ears of the clip, as shown in the plan view, Fig. 2. The bushing has a square hole, as have also the ears, through which projects a correspondingly shaped bolt having a screw-threaded end and retaining nut, whereby the bushing is held from turning, while the socket end of the thill iron turns on the bushing. By tightening the nut the ears are drawn against the ends of the bushing, thereby preventing rattling, and as the ends of the bushing are worn, the ears may be drawn up. The wear upon the screw-threaded parts of the bushing and socket will be small, making the coupling durable and one with which rattling can be easily avoided.



LOEHR'S THILL COUPLING.

AN IMPROVED HEAD-REST FOR CAR SEATS.

The accompanying illustration represents a convenient head-rest for application to the seats of cars, which may easily be placed in the position of use and readily removed when not required. It has been patented by Mr. Clement W. Hooven, of Winchester, Ind. The head-rest slides in a casing having a ratchet bar with which the head-rest is joined by a yielding connection, a ball and socket joint, with a friction spring, allowing the head-rest to adjust itself automatically. To the back of the casing, near its lower end, is a looped spring which engages an offset strap secured to the back of the seat, the seat having a recessed bar to receive the spring, and the bar having projecting ears with spring-acting catches, as shown in Fig. 3, to engage the spring and hold it in the position of use. The upper end of the casing is provided with an eye by which the head-rest may be suspended when not in use, and the whole device is very simple, being adapted for attachment to any coach seat, to make a perfect head-rest.



HOOVEN'S HEAD-REST.

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THE MANNLICHER GUN.

Austria, like France, has adopted for the arming of her infantry a gun of small caliber, and has chosen the model presented by the armorer Ferdinand Mannlicher. This weapon, like the French gun (the Lebel), is of 8 mm. caliber, and fires a steel-incased ball.

The closing of the Mannlicher gun differs completely from that of guns provided with a bolt. The object of the inventor has been to suppress the lateral motion of the movable breech, and to effect the opening and closing of the gun by a single horizontal motion, such an arrangement permitting of exhausting the magazine of cartridges without removing the weapon from the shoulder. It is doubtful whether such a result can be obtained in practice, on account of the friction of the movable breech in its socket, this constituting a sufficient resistance to quickly fatigue the soldier at the outset; but, even supposing that the magazine can be exhausted without taking the gun from the shoulder, the opening and closing are not easily enough effected to allow the rapidity of firing to be perceptibly increased.

The opening and closing are effected as follows: In order to open the weapon, the lever, A, is grasped with the right hand and pulled back. To close the gun, the movable breech is shoved forward by means of the same lever. The gun being loaded, as will be explained further along, the movable head carries along into the chamber the first cartridge of the magazine, and the cock, B, meets the trigger, V, which arrests it. If the pressure on the lever is kept up, the coin, C, enters the bolt, D, and forces it to fall and enter the recess, E.

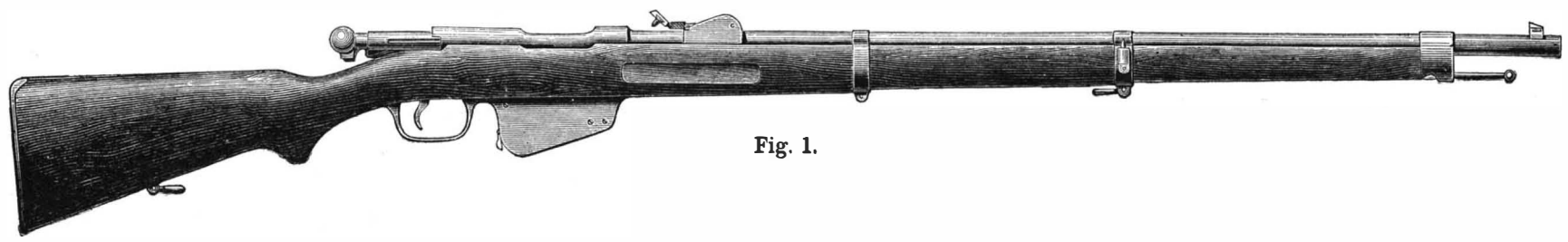

Fig. 1.

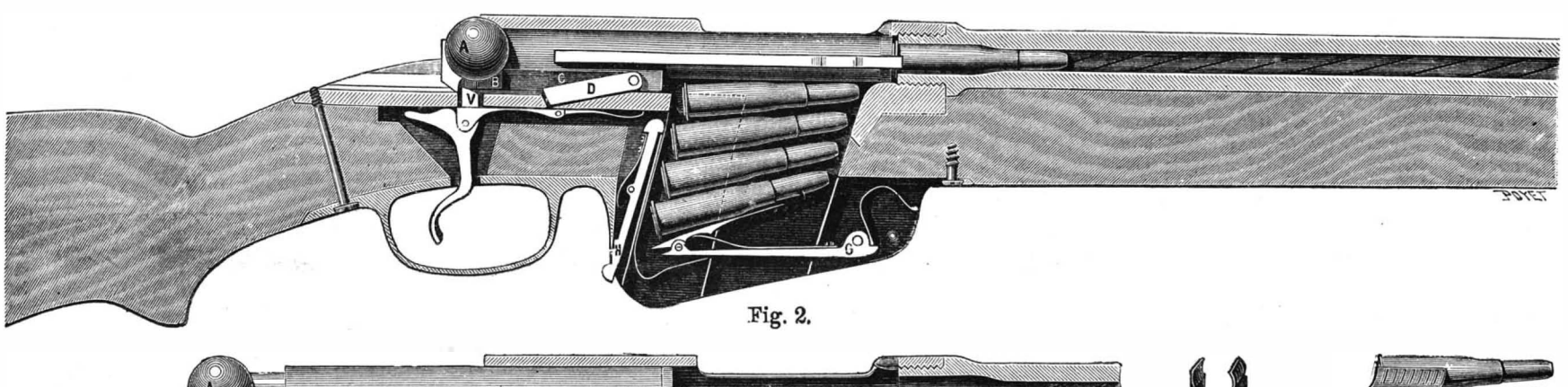

Fig. 2.

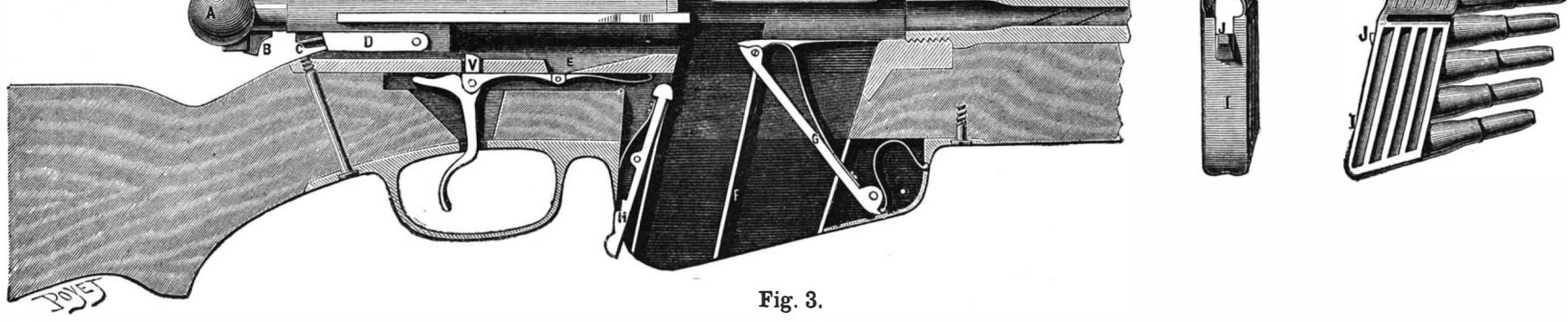

Fig. 3.

As a repeating gun, the Mannlicher weapon belongs to the two categories of arms with fixed magazine and those with a movable one. Beneath the breech socket there is a steel plate magazine, F, which contains the cartridge lever, G, and the hook of the feeder, H. The repetition is completed by a feed box, I, of very light steel plate, containing five cartridges. To fill the magazine, the soldier opens the gun, as shown in Fig. 3, and takes the feed box and introduces it into the magazine through the recess in the socket until the part, J, has crossed the hook, H. During this operation the last cartridge, which rests upon the upper part of the lever, G, forces this piece to descend (Fig. 2). During the firing, the cartridges rise in succession under the action of the lever, G, and at the moment of the introduction of the last cartridge into the chamber, the lever, experiencing no further resistance, resumes its place (Fig. 3), and the feeding box, which is no longer held, is thrown automatically out of the gun by the pressure of the hook, H.

To consider but the repeating mechanism, the Mannlicher gun may, as regards its simplicity, the strength of its parts, and its operation, be considered as the most perfect one that has been made up to the present.—*L'Illustration.*

PAINT stains that are dry and old may be removed from cotton or woolen goods with chloroform. First cover the spot with olive oil or butter.

Some Golden Rules.

The following, from an unknown source, contains advice which experienced business men indorse and young men will do well to follow:

Have but one business, know it thoroughly, and attend personally to its minutest details. Be self-reliant, concentrate your energies in a determination and supreme effort to conquer success. Keep your own counsel, attend strictly to business, and never dabble in anything foreign to it, curtail your expenses, never sacrifice safety to prospective large returns, cut short your losses and let your profits run on, and make your prime movers industry, economy, and fair dealing. It is the merest rant and bosh to rely on Luck. He is always indolent and whining, folding his arms, drinking and smoking, waiting for big prizes in lotteries, or lying abed expecting a letter with news of a legacy. On the contrary, Labor and Pluck are the invincible heroes who conquer success; they strike out new paths, create, contrive, think, plan, originate, take all legitimate risks, toil to surmount obstacles, push forward, win renown by success. The glorious galaxy of successful business men and illustrious authors have all been hard workers. Shun bad company and the prevalent vices of the day, never loan a borrowing friend more than you are able to lose if he cannot pay, and never take a loan on importunity. Never borrow money to speculate with. Acquire knowledge. It is only enlightened men who successfully hold their own with the surging masses who throng the road to riches. Avoid law and legal squabbles of every kind. In discussing business disagreements, keep cool. Make all the money you can and do all the good you can with it, remembering that he who lives for himself alone lives for the meanest man in creation. If engaged in public business, advertise it; be punctual in meeting promised payments; keep short accounts; settle often; be clear and explicit in making bargains. Be civil and obliging as well as decisive and prompt with customers, and do not overtrade your capital. Finally, in the maturity of life, don't rust out by retiring from business; keep bright by useful effort, remembering that industry and happiness are inseparable.

Life in the Great City.

Among the dangers peculiar to life in New York are the injuries to person and property resulting from the carelessness of employes connected with the elevated street railways, of which some forty miles are now in operation within the city. The railway people think nothing of piling up the coal on their locomotives in such a way that more or less of it rolls down into the street twenty feet below, to the danger of the crowds of people; while showers of hot water, oil, and live coals are not uncommon. It is only now and then that the companies are called to account for the injuries thus occasioned, as few people are willing to go to the expense and trouble of fighting such rich corporations. Here is a case, however, in which justice appears to have been done, in part at least:

Pierce S. Marx recently obtained a verdict of $6,000 as damages against the Manhattan Railway Company before Judge Barrett and a jury in the Supreme Court. On the 17th of October, 1883, while Marx was standing on the corner of the Bowery and Doyer Street, a large piece of coal dropped from the locomotive of a passing train, and, striking the sidewalk, broke into pieces. A small particle of the coal struck Mr. Marx in the right eye, and he lost the sight of it. He sued the railroad company to recover $25,000 damages. The case was on trial for several days, during which time a great deal of testimony was taken as to the condition of Mr. Marx's eye. The company endeavored to prove that the injury was not caused by the coal at all.

Cultivation of Nutmegs in New Guinea.

Paddling into a little cove, says Captain John Strachan, on the south side of the bay, we landed beside a clear ripplingstream, and, having ordered the whole of the men to march in Indian file in front, we started by a little rugged path into the mountains, with my interpreter immediately behind me and the Rajah just in front. Every foot of the journey, which was laborious in the extreme, disclosed fresh scenes of verdure and tropical splendor. Winding along the sides of deep ravines, sometimes dragging ourselves up by the creepers and undergrowth, we ultimately attained an altitude of about 1,000 feet above the sea, and then entered the nutmeg country. Here we halted and rested. The Rajah pulled some of the nutmegs, and explained how far they were from being ripe.

Having rested sufficiently, we again started forward, and after scrambling along for about an hour, we gained a fine piece of table-land, over which we traveled for about another half an hour, when we reached three houses erected in the very heart of the forest. These were used by the natives for drying the nutmegs. The country was everywhere magnificent, and the aroma of the spice-laden air delicious. Nutmeg and other equally valuable trees were everywhere growing in great profusion. The fruit of the nutmeg in appearance resembles a pear, and, when ripe, opens and displays the nut covered with a beautiful red coating of mace. The nuts are then picked from the tree, put into baskets, and taken to the houses, where they are husked and placed on shelves. They are then partially roasted over a slow fire until all the moisture is extracted. After this they are cooled and carried down to the village in nets ready to be bartered to the Bugis, Arabs, and other traders who frequent the Gulf in their small prows or junkos at the proper season.—*Tropical Agriculturist.*

SOME one tells how to prepare soft coal in such a way, at small cost, that there will be no accumulation of soot in the chimney, and that the under sides of the stove lids will be kept clean. Here it is: For a ton of coal buy a few cents' worth of common salt, make a brine of it and pour over the coal. We do not say that the result will be as effective as the promise, but it is worth trying.

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Prevention of Typhoid Fever.

BY R. HARVEY REED, M.D., SECRETARY STATE SANITARY ASSOCIATION AND HEALTH OFFICER, MANSFIELD, OHIO.*

You all, no doubt, remember the terrible scourge of typhoid fever that visited Plymouth, Pa., only a few years ago, during which 1,104 persons were stricken down with this foul disease, of whom 114 died, while the actual cost of that epidemic was carefully estimated at $97,120.25, all in hard cash, saying nothing of the loss to that village from 114 deaths, whose yearly income, when in health, amounted to $18,419.52, to all of which is yet to be added the sorrow and suffering that cannot be measured in dollars and cents.

An investigation into the cause of this greatest of modern local epidemics by so eminent an authority as Dr. Benjamin Lee, Secretary of the State Board of Health of Pennsylvania, showed that in a house on Girard Avenue, in Philadelphia, a blacksmith was taken down with typhoid fever in September, 1883. After a few days, however, he was removed to the Episcopal Hospital, from which he was discharged on the 13th of the following October.

In the following May or June, 1884, a street car conductor, who was boarding at the same house on Girard Avenue, was taken down with the fever, and also taken to the hospital for care and treatment.

In the following July, a huckster, boarding at the same house, was attacked with typhoid fever and sent to the same hospital.

Here were three cases, all boarding at the same house, and all taken down with typhoid fever, the attacks ranging over a period of about eleven months.

A CASE OF AERIAL INFECTION.

Dr. Lee tells us that from all the information he could gather by personal inspection and diligent inquiry of neighboring physicians and other observant citizens, he had not the slightest doubt that, while there were numerous and glaring unsanitary conditions in the vicinity, the real cause of the cases of typhoid fever occurring in this ill-fated house on Girard Avenue was to be found in the grossly defective cesspool, with its foul exhalations, completely shut in from lateral air currents, and pouring through open doors and windows into the kitchen and dining room, to be inspired by the inmates, or, worse still, to be absorbed by the food in course of preparation for the table, and thus brought in contact with the alimentary mucous membrane. "It is proper to state in conclusion," he adds, "that the dangerous character of this particular cesspool cannot be abated or removed by any amount of cleansing or emptying, however frequently performed. Its complete abolition alone can bring safety to the household."

THE COURSE OF THE CONTAGION.

"Into this house, with its history of fever and its foul environment, late in December, 1884, came David Jones, fresh from his mountain home, overlooking the vale of Wyoming, to visit his city brother and spend his Christmas holidays. Forth from this house, early in January, 1885, again he went, but went not as he came. A poisoned blood now coursed through his veins, and shortly after returning to his home he was prostrated with what his physician soon pronounced typhoid fever, and lay on his back for many weeks in his cottage on the banks of a little stream which supplies the reservoir of the town at the foot of the mountain.

"This little town at the foot of the mountain was Plymouth, a mining town of some 8,000 or 9,000 inhabitants, situated on the right bank of the Susquehanna River, three miles below Wilkesbarre. As a large part of the town is upon a side hill, the surface water readily finds its way into the Susquehanna River.

"No system of sewers and no effort at systematic drainage have ever been introduced, and the borough council seem singularly apathetic in the matter of sanitary reform. The drainage from each house is into cesspools situated in the back yard, or, in some cases, it is even into the streets themselves, which, in parts of the town, have not a proper arrangement of gutters for disposal of this drainage.

"It was found, on further investigation, that the house in which the young man lay with typhoid fever he had contracted at his brother's house in Philadelphia was situated so near the stream supplying the water reservoir at Plymouth that, as soon as the weather permitted a sufficient thaw to allow the frozen accumulations of weeks of dejection from this one case to reach this stream, only a few yards distant, with the conformation of the ground favoring its course to this water supply, a local epidemic of such magnitude ensued during the following April and May of 1885, and continued until the following September, that it is scarcely paralleled in modern history, and at the same time making this 'one of the most instructive as well as one of the most terrible instances which ignorance and negligence have contributed to the records of disease.'"

THE FEVER FOLLOWS DRY SEASONS.

Professor Vaughan, in speaking of the Iron Mountain epidemic, to which I have already referred in this paper, says: "It is well known that typhoid fever follows dry seasons, and is coincident with low water in wells. There are, on an average, 1,000 deaths and 10,000 cases of sickness from this disease annually in Michigan. These figures can be greatly reduced if people will cease polluting the soil about their houses with slops, garbage, cesspools, and privy vaults, and will see that their drinking water is pure beyond all question. When there is any doubt, the water should be boiled and kept uncontaminated afterward. While the germ most frequently finds its way into the body with the drinking water, it may be taken in with any food, and even with the air. The earth, air, and water about our homes must be pure, if we escape this disease altogether. When cases of typhoid fever occur, all discharges should be thoroughly disinfected."

THE EFFECT OF PURE WATER IN MANSFIELD.

Since Mansfield has practically ceased the use of water from wells throughout our city and adopted the use of water supplied by the powerful artesian wells drilled just north of our city, and which have been given the flowery title of "wonderful artificial geysers," a chemical analysis of which was made by Professor C. C. Howard, of Columbus, and showed the water to be unusually pure (and more recently pronounced by the Professor, in a private letter to the writer, the purest water that he has examined for any city in the State of Ohio), the prevalence of typhoid fever in our city has greatly diminished, only one death from this disease having been reported during the summer and fall, and but a few cases having occurred in the city, and they were all in persons who used well water, which is all more or less contaminated with organic filth throughout the principal part of our city, which certainly demonstrates to any unbiased mind that typhoid fever is a preventable disease, and can be prevented by the use of pure water.

SIX FACTS TO BEAR IN MIND.

Before closing this paper, allow me to call your special attention to a few facts:

1. Typhoid fever is caused by the introduction of a specific germ into the alimentary canal.

2. That this specific germ multiplies in the alimentary canal, and in turn is thrown off in the stools of the patient.

3. That its vitality is much greater than at first supposed, resisting a variation of temperature ranging from even below the freezing point to 133° Fah., without being destroyed.

4. That the germ may be communicated from one person to another by water, milk, foods, and air, in the manner illustrated in the cases cited in this paper.

5. To prevent its spread, all the dejecta should either be burned at once (which is preferable) or thoroughly disinfected, by throwing them into a pot of boiling water and thoroughly cooking them, or use some effective germicide, such as a strong solution of the bichloride of mercury, in sufficient quantities as to insure their destruction before they are buried, which should be at a sufficient distance from any neighboring water supplies as to insure their freedom from contamination.

6. If the water supply is of a suspicious character, thoroughly boil it before using, and then place it where there is no possibility of its becoming infected. If ice is to be used to cool the drinking water, keep it out of the water, only packing it around the water vessel, but not putting ice into the vessel or allowing the melted ice in any way to enter your drinking water, and thus take the chances on its contamination.

By the strict observation and practical application of these few simple hints, I am certain you will soon be led to believe that typhoid fever is a preventable disease.

*From a paper read at the sixth annual meeting of the Ohio State Sanitary Association, held at Canton, Ohio, November 14 and 15, 1888.

Rabbit Skins.

When the Acclimatization Societies of Australasia introduced the rabbit some years ago, they thought they were accomplishing a good work, and little anticipated what a serious injury these rabbits would effect in less than ten years, and that their extermination would be a costly and impossible work. Rabbits have so increased now in Australia and New Zealand that the colonists are at their wits' end how to repair the evil. The extent of the injury done to the pasturage required for sheep may be inferred in some measure from the enormous number of rabbit skins exported, which, however, prove a blessing to the cheap furriers of Europe and America. A local industry has also sprung up in the colonies in making soft felt hats from their fur. Coney wool was encouraged and valued in England a hundred and fifty years ago, and is now worth 7s. a pound. The damage done to the crops in the Australian colonies by the little animals that furnish the skins for export has become of such magnitude as to furnish the subject of parliamentary legislation there.

From the single colony of New Zealand there has been exported about 70,000,000 skins, valued at nearly £750,000. But the property destroyed by these rodents is estimated by millions, and this industry of rabbit skins is one which the people there do not wish to see prosper. In Victoria the colony is asserted to have sustained a loss of about £3,000,000. The cheap linings of coats and ladies' cloaks, and many of the dyed articles of fur, are due to rabbit skins, home and foreign. In the last ten years 29,000,000 rabbit skins have been exported from Victoria. In addition to the exports from the colonies many have been used locally by hat manufacturers and others, and large numbers have doubtless been destroyed or allowed to decay. The extensive supply from Australasia has flooded the English market, and the trade has on hand a supply sufficient to last for a year or two.

The English rabbit breeders also found it to their advantage to kill rabbits mainly for their skins, and the supply of home skins is said to reach 30,000,000 annually. Belgium, which supplies us with the tame-bred rabbits so largely appreciated and imported for food, sends away over 6,000,000 rabbit skins, but then these skins are much larger, of a finer color, and better fitted for furs than those of the wild rabbit.

In some of the Australian colonies attempts were made to preserve their flesh in tins for food. One company in South Australia employed forty or fifty trappers, and thus prepared 6,000 or 7,000 rabbits a day. But this utilizing process has been dropped since the wholesale poisoning and other methods of extermination have been resorted to, the public becoming shy of eating the rabbits as food.—*Journal Society of Arts.*

Small Timber Better than Large.

The statement that a 12 by 12 inch beam built up of 2 by 12 planks spiked together is stronger than a 12 by 12 inch solid timber will strike a novice as exceedingly absurd, says the *Mississippi Valley Lumberman.* Every millwright and carpenter knows it also, whether he ever tested it by actual experience or not. The inexperienced will fail to see why a timber will be stronger simply because the adjacent vertical longitudinal portions of the wood have been separated by a saw; and if this were the only thing about it, it would not be stronger, but the old principle that a chain is no stronger than its weakest link comes into consideration. Most timbers have knots in them or are sawed at an angle to the grain, so that they will split diagonally under a comparatively light load. In a built-up timber no large knots can weaken the beam, except so much of it as is composed of one plank, and planks whose grain runs diagonally will be strengthened by the other pieces spiked to it.

Use of Vanillin.

Commercial vanillin is not made from vanilla, but from the cambium sap of the pine, which contains coniferin or coniferyl-alcohol. The latter is converted into the former by a process of oxidation. The discoverers of the chemical constitution and of the method of artificial preparation of vanillin, Messrs. Tiemann & Haarmann, have gradually improved the process; so that the commercial product is fully equal in aroma to the natural vanillin contained in vanilla beans. And the vanillin is now sold at a price which makes it decidedly more economical to use it than an equivalent amount of the beans themselves. There are several manufactories in Europe which do not seem to have as yet combined to a "trust." In consequence, the price has been depressed more and more.

At one time it was supposed that artificial vanillin would ruin the vanilla industry and trade, just as artificial alizarin has practically ruined the madder industry. But, curiously enough, this has not been the case. Vanilla holds its own extremely well. In fact, there is much more vanilla grown and sold at the present time than before vanillin was known as a commercial product. And yet, the latter is also consumed in constantly increasing quantities.

There is one reason for this. It is well known that an extract of vanilla made from the bean contains other matters besides the vanillin, among them what is usually termed "extractive" and a good deal of coloring matter. Now these substances have the power of binding or holding the odor of vanilla much more energetically than a simple neutral solvent would. Therefore, if two liquids are made of as near equal strength in odor and taste of vanillin as possible, one from vanilla bean and the other from vanillin, and if these two liquids are used, in equal proportions, to flavor equal amounts of any inert or insipid mixture, it will be found that the one flavored with the extract of the bean will retain its odor longest. But this property is not always required of the flavoring. When used for culinary purposes, it is seldom required to preserve the odor or taste of some flavored delicacy more than 48 hours. On the other hand, when chocolate or other confectionery is made on the large scale for the market, it is necessary to insure the stability of the odor and taste for as long a time as possible. Hence while artificial vanillin is perfectly satisfactory in the former case, the natural bean is preferred in the latter. It is usually considered that 1 oz. of vanillin is equivalent to 40 oz. of good vanilla beans.—*American Druggist.*

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NEW RAILROAD OVER THE ROCKY MOUNTAINS OF COLORADO.

It was not many years ago that the ore production in the State of Colorado did not exceed three or four millions of dollars a year. The introduction and extension of the railroad systems throughout the State, in spite of the many physical difficulties that stood in the way, has worked a great change, and towns which, a few years ago, contained but a few scattered houses, with a handful of desperadoes as its only inhabitants, are now flourishing cities, with its town hall, theaters, and perhaps a few churches. This is due to the fact that Colorado has risen to the first rank among the States and Territories as a producer of the precious metals, for gold and silver combined, as well as for silver alone; while for gold it holds, according to the last census report, the fourth rank. In relation of production to area it also holds the first rank for gold and silver combined, and for silver alone, and the third for gold alone.

The tremendous increase in the production may be noticed in the fact that the yield in 1880 amounted to $19,250,000 in gold and silver alone, and if there be added to this the value of lead and copper in crude metal produced, there would be a total value of metallic product of over $22,750,000. How dependent this product is upon the extension of the railroad systems throughout the State is illustrated by the growth of the product in proportion as the railroads were multiplied.

A most interesting engineering work is now being prosecuted in the counties of Ouray and San Juan, and if reference be made to a map of Colorado, it will be seen that the town of Ouray is the terminus of one branch of the Denver and Rio Grande Railroad. It will also be observed that Silverton, which is separated from Ouray by high mountains and deep valleys, is also the terminus of another branch of the Denver and Rio Grande Railroad. It is proposed to connect these two towns by a railroad, to be known as the Silverton Railroad, and the work on it is now being prosecuted. Owing to the wild and rugged nature of the country through which the road passes, rather primitive methods have been resorted to in the construction of the road, which would suggest Mexico or South America rather than one of the richest mining States of the Union. The road is being built in the bed of an old turnpike toll road that connected these two points, and which was constructed by and is the private property of Mr. Otto Mears, a prominent citizen of Colorado, and one who has done much to develop the State by introducing extensively the toll road systems. This road is 23 miles long, and at certain points had to be blasted out of solid rock. It was constructed at a cost of over $200,000. One of the views, which we reproduce from a photograph, gives a good representation of one of the wildest sections, where the road was cut out of the side of the cliff.

It winds along a mere ledge on the face of the cliff and the rocks tower above for thousands of feet, while a thousand feet below flows the Uncompahgre River through a deep gorge, which is impassable to man.

It is said that there are over 5,000 mining claims and mines recorded and being worked within ten miles of this point.

In the cut at the right, the toll road is again seen as it passes over the stream above the Bear Creek falls. The railroad will pass over the stream at this point. The falls are very beautiful, and fall in a single unbroken sheet, a distance of over 600 feet, and form one silver wave unvaried save by an eternal rainbow. Some idea of the height may be gained by comparing the falls with the pines growing upon the banks above. Silver Lake, which is represented in the middle cut, is situated above the timber line on King Solomon's mountain, at an altitude of about twelve thousand five hundred feet. The surrounding country is very rich in ores, and at the right of the lake is located the Silver Lake Black Diamond mine, one of the richest producers in Colorado, yielding as it does gold, silver, lead, and copper ores. The road leading from the mine to the valley on the other side of the lake may be indistinctly seen. A little above this valley, at about the center of this picture, is the Buckeye mining property, which is also very rich in ore.

The method of transporting the rails is illustrated in the bottom cut. The rails are strapped to the backs of donkeys, the ends dragging on the ground behind. The donkeys are not provided with either bridles or bits, but follow each other up the sides of the mountains single file. The railroad, when completed, will be 17 miles long. The highest altitude reached is 11,200 feet, at a point near Red Mountain. There will be fourteen side tracks connecting with the main track, which will bring fourteen mines into direct railroad communication with the great railroads of the State. The expense of this narrow gauge road is estimated at about $1,000,000. The maximum grade is 237 feet per mile.

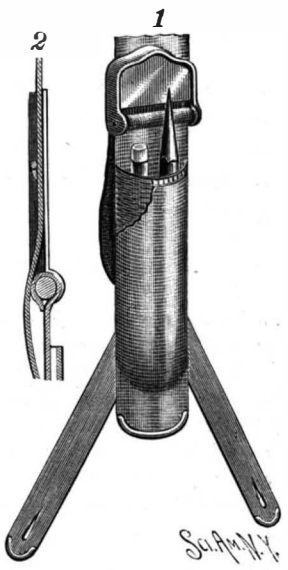
To melt rubber.—Rubber can be melted by heating in a can over a water bath, that is, the heat must be hot enough to melt, but not burn.

A New Society of Engineers.

Under the auspices of the Engineer Corps of the Navy, steps have been taken to organize the "American Society of Naval Engineers." The object of the society is to promote a knowledge of naval engineering by the reading, discussion, and publication of papers on professional subjects; to publish the reports of boards and accurate accounts of the trials of all naval machinery, plans of new machinery, and of the results of such experiments and other inquiries as may be deemed essential to the advancement of the science. The society will be composed of members, associates, and honorary members, comprising engineers at present connected with the navy and those formerly connected with the service.

A SUSPENDER POCKET FOR PENCILS, ETC.

The illustration herewith represents a suspender made with a pocket so arranged as to conveniently hold small articles, such as pencils, spectacle cases, and the like. It has been patented by Messrs. Tom B. Pell and James W. Knox, of Lewisport, Ky. In the lower end of the buckle, by which the suspender is vertically adjusted, is a crossbar from which depends a strip or piece of non-elastic webbing, to the face of which is secured a pocket, open at the top and closed at the bottom. This pocket consists preferably of elastic webbing, in which the elastic runs transversely. The lower ends of the suspender are attached to the piece of webbing back of the pocket, the suspender being adjustable without interference with the pocket portion.



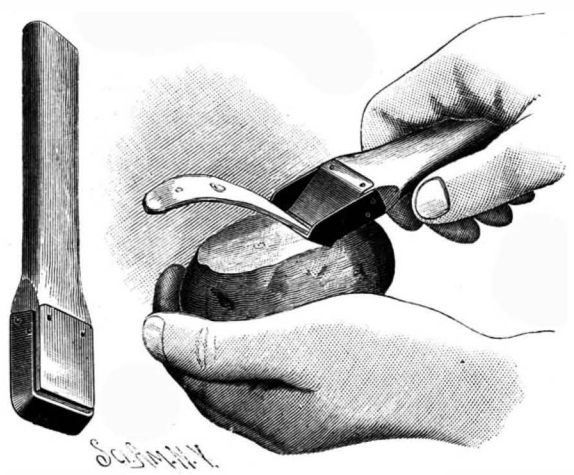
PELL AND KNOX'S SUSPENDER END.

Frozen Water Pipes.

The season for frozen pipes is approaching, and the *Southern Lumberman's* answer to an inquirer is worthy a trial. "If the pipe is underground, or covered by a wooden conduit, place a bushel or more of unslaked lime over the point where the pipe is known to be frozen, put water enough on the lime to slake it, and cover with old sacks, canvas, sawdust, or anything that will keep the heat the slaking of the lime generates from going off in the air. This is a better plan than to dig up the pipes and apply fire by burning coke or wood, but will require more time. Where water pipes are conveyed only a few inches underground, as is customary in the South, the lime process might be superseded by the burning of slabs and refuse over the line of pipe. But the best plan is to prevent the pipes freezing, on the broad principle that an ounce of prevention is worth more than a pound of cure."

AN IMPROVED VEGETABLE KNIFE.

A simple form of knife whereby vegetables can be easily and rapidly pared without unnecessary waste is



FOOTE'S VEGETABLE KNIFE.

shown in the accompanying illustration, and has been patented by Mr. Frederick S. Foote, of No. 167 West Twenty-third Street, New York City. The blade has side members or ears by which it is secured to the handle, the central cutting edge of the blade standing a short distance in front of a metal-faced edge of the handle, and projecting slightly below it. The lower surface of the handle is made flat to act as a guard to prevent the knife from entering the vegetable or object being cleaned too great a distance. The side members of the blade are sharpened near their outer corners, for removing eyes of potatoes or reaching depressions in the surface of vegetables being pared.

Correspondence.

Oersted's Discovery of Electro-Magnetism.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN for December 22, Mr. Hopkins says, in his very interesting article on "Simple Experiments in Physics," that Oersted made his celebrated discovery of the connection between electricity and magnetism while passing through his laboratory, compass in hand, and having his attention attracted to the strange behavior of the needle. The inference is that the discovery was accidental. The usual accounts given of this experiment accord with that given by Prof. Mendenhall, in his "Century of Electricity." Oersted, in common with other scientists of that time, had long been convinced that there must be some connection between electricity and magnetism, and was seeking to establish it experimentally. To quote from this author:

"It was in the winter of 1819–20 that Oersted's efforts were crowned with success, and his victory was won in the presence of many besides himself. It was during the inspiration of a lecture before his pupils that the thought occurred to him to try a new mode of attack. A battery of considerable power was on the table, and near by was a suspended magnetic needle. He announced to his hearers what he was about to try, and then seized the wire joining the two poles and placed it parallel and over the needle. Instantly the needle swung out of its position, and one of the most magnificent discoveries of modern science stood revealed as an accomplished fact."

The great importance of this discovery makes the circumstances under which it was made of considerable historical importance. Hence, would like to know which is the correct version.

W. M. STINE, *Prof. Physics.*
Department of Physics and Chemistry,
Ohio University, Athens, O., Dec. 24, 1888.

To the Editor of the Scientific American:

With reference to the letter of Prof. W. M. Stine, referred to me by you, I will say that my understanding of the circumstances under which the discovery of electro-magnetism was made by Oersted is in accordance with the article referred to.

Shaffner, in his "History and Description of the Semaphoric, Electric, and Magnetic Telegraphs of Europe, Asia, Africa, and America," p. 114, describes a visit to Oersted's laboratory as follows:

"In the year 1854 I visited Copenhagen, and the first object of my curiosity was to see the laboratory of Oersted. Through the generous attention of M. Faber, the Director-General of the Telegraphs of Denmark, my desire was gratified. I saw the room in which electro-magnetism was dicovered and the small compass that developed it.

"Professor Oersted was engaged in arranging some wires connected with the voltaic battery, preparatory to making some electrical experiments which he had in view. While thus adjusting the wire conductor, he had in his hand a small compass, some two and a half inches in diameter. Sometimes his hand, with the compass, was above the wires, and at other times below them. He observed the needle of the compass to move, and his attention being once directed to the development, the discovery followed as a sequence. That discovery, at the time, was made known in the following language, viz.: 'When a magnetic needle is properly poised on its pivot at rest in the magnetic meridian, and a wire arranged over and parallel to the needle, in the same vertical plane, and the ends of the wire made to communicate, respectively, with the poles of a voltaic battery, the needle will be deflected.'"

Dr. Alfred Ritter von Urbanitzky, in his "Electricity in the Service of Man," page 8, says: "It has been said that an apple falling to the ground caused the discovery of the law of gravitation; the motion of a frog's leg led to the discovery of galvanism; chance led Oersted to observe the influence an electrical current has on the magnetic needle."

Clerk-Maxwell, in his "Electricity and Magnetism," vol. 2, page 475, refers to this circumstance as if it were accidental. In all the other authorities which I have examined, this question is left open to conjecture.

GEO. M. HOPKINS.
New York, December 28, 1888.

Small Bore Balls.

Recent experiments on the effects in the human body of the new French balls (Lebel gun) have shown many interesting facts. The ball of the Lebel gun is a small one (8 millimeters diameter, instead of 11), which travels faster than those formerly used (570 meters per second, instead of 450), and is clad in a dress of *maillechort* (German silver), which gives it a greater hardness. It produces much smaller wounds, and these are more limited than with other balls; bones are not so much shattered; and the fact that the ball does not (up to the distance of 1,200 meters) remain in the body, renders the treatment much easier. The Lebel ball may be considered as a humanitarian and philanthropic instrument, in a large measure.

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SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

A simple and efficient rotator, in which the means of communicating rotary motion does not appear on the screen, is shown in Figs. 1 and 2. In this apparatus a glass wheel, provided with a brass rim, is furnished with a shaft, which turns in a hole bored in the center of a thick glass supporting disk. The brass rim of the wheel is provided with a series of radial vanes, also with three clamping screws bearing on springs in the interior of the rim for clamping the objects to be rotated. A nozzle attached to the back piece is arranged to direct a jet of air upon the vanes, and thus cause the glass wheel to revolve. A Fletcher blow-pipe bellows furnishes a suitable blast for this purpose.

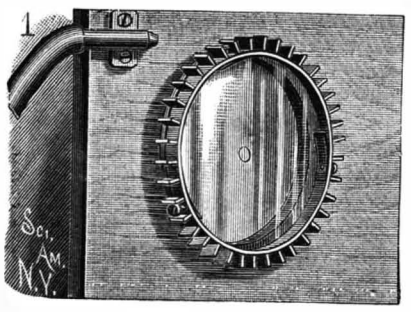


Fig. 1.—ROTATOR FOR THE LANTERN.

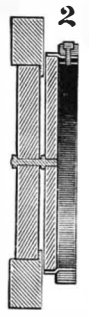


Fig. 2.—SECTION OF ROTATOR.

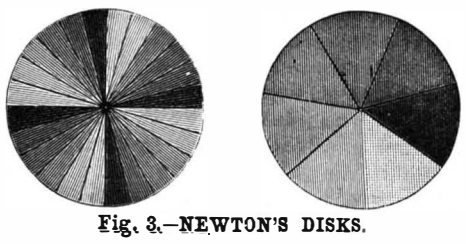


Fig. 3.—NEWTON'S DISKS.

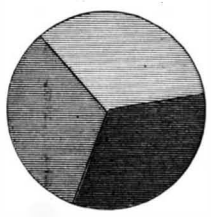


Fig. 4.—BREWSTER'S DISK.

To the rim of the glass wheel are fitted disks for blending colors. Among these are Newton's disks, Fig. 3, in one of which the colors of the spectrum are four times repeated, also a Brewster's disk. These disks are made by attaching colored films of gelatine to glass, or by tinting the glass by means of colored lacquer. The rotator is also provided with a circular cell filled with the liquids of different densities, to which allusion has been made in a previous article. This cell, when at rest, appears as in Fig. 5, and when in motion as in Fig. 6, the different liquids being compelled to assume certain relations with each other by centrifugal force, the heavier liquid, *a*, taking the position as far from the center of rotation as possible, the liquids, *b c d*, arranging themselves in the order of their densities.

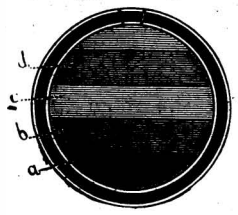


Fig. 5.

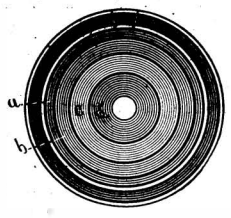


Fig. 6.

ACTION OF CENTRIFUGAL FORCE ON LIQUIDS.

The effect of a helix on particles of magnetic material suspended in a liquid is shown in the experiment illustrated by Fig. 7, which is arranged for projection or for individual observation. A short section of glass tubing, 2¼ inches in diameter and ¾ inch long, is ground true and smooth at its ends and clamped between two plates of glass with intervening rings of elastic rubber. Before clamping the parts together, one end of the glass tube is cemented to the packing ring, which in turn is cemented to the glass, and a small quantity of fine iron filings is placed in the cell, the cell is filled with a fifty per cent solution of glycerine and alcohol, and a helix formed of five or six layers of No. 16 magnet wire is placed upon the glass tube. The remaining packing ring is placed on the end of the glass tube, the second glass plate is put in position, the clamps are applied, and the apparatus is ready for use. This method of making the cell leaves an air bubble, which is needed to allow the liquid to expand freely.

By thoroughly agitating the liquid, the iron filings will be evenly distributed throughout the cell, and they will be prevented from falling immediately by the viscid nature of the solution.

When four or five battery cells are connected with the helix, the iron particles arrange themselves radially or at right angles to the wire surrounding the cell.

The effect produced in the magnetic field by the presence of an armature is shown by the lantern experiments illustrated in Figs. 8 and 9.

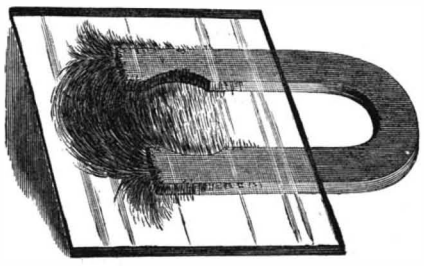


Fig. 8.—THE MAGNETIC FIELD.

In Fig. 8 is shown a permanent magnet having the form of a field magnet of a dynamo. This magnet is cemented to a plate of glass. When the magnet thus arranged is placed in a vertical lantern, with the glass uppermost, and a few fine iron filings are sprinkled on the glass, the usual magnetic curves are formed. The lines will extend straight across from one polar extremity of the magnet to the other, and at the ends will be formed symmetrical, approximately semicircular curves. When a cylindrical piece of iron, representing the armature core of a dynamo, is inserted between the poles of the magnet in the place usually occupied by the armature, the lines are deflected inward, becoming perpendicular to the periphery of the armature. The iron representing the armature is cemented to a second plate of glass. The iron particles arrange themselves in a more pronounced figure if the glass plate upon which they are sprinkled be jarred slightly.

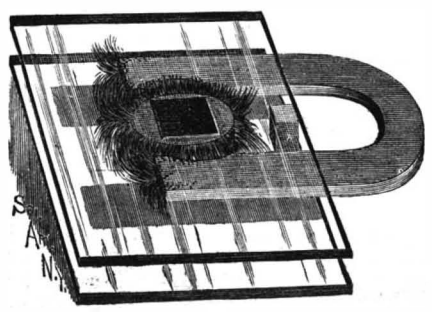


Fig. 9.—EFFECT OF AN ARMATURE ON THE MAGNETIC FIELD.

A very simple, pleasing, and at the same time instructive lantern experiment is illustrated in Fig. 10. A loadstone supported by a brass wire from the baseboard is arranged to project into the field of the lantern without showing the wire. Under the loadstone is placed a small cup filled with fine iron filings, and also in the field of the lantern. An unmagnetized needle is dipped in the filings and removed, showing that it has no power to lift the filings; then while it is still in the field of the lantern, the needle is rubbed across the end of the loadstone and dipped the second time into the filings. This time the needle takes up a quantity of the filings, showing that the loadstone has imparted magnetic properties to the needle.

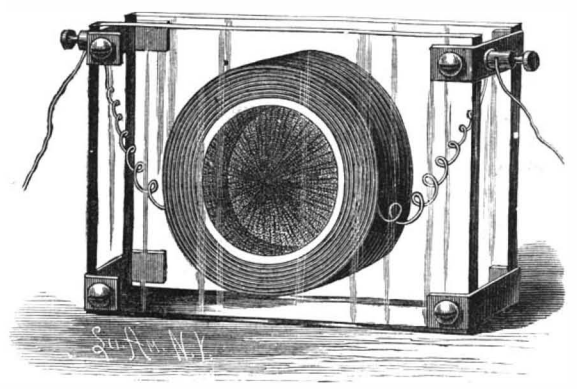


Fig. 7.—EFFECT OF A HELIX ON SUSPENDED PARTICLES OF IRON.

To render this experiment complete, an erecting prism must be used to cause the image to appear right side up on the screen.

THE LOWTH TELEPHONE.

This is a new and in some respects remarkable instrument, by which speech is transmitted, without making use of sound waves as in the Bell and other forms of electrical telephones.

In the Lowth telephone the transmission is effected by means of an electrical plug which is placed against the neck of the operator, near the vocal organs. The vibrations of the neck produced by the act of speaking shake or move the plug, thereby giving rise to corresponding electrical undulations, which pass over the wire to a receiver at the opposite end of the wire, and are there heard by the listener. A receiver and plug are both combined in one instrument, as shown in our engraving, which is from a photograph, and the telephone is used in the manner there represented. The instrument is held to the ear with the plug resting against the throat, as shown. The operator then speaks, and the voice is heard at the other end of the line, with the utmost clearness.

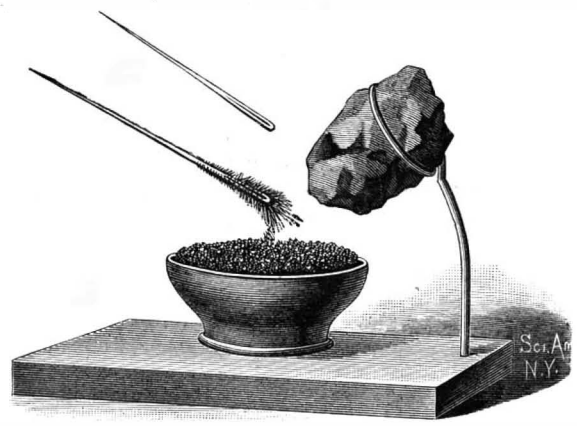
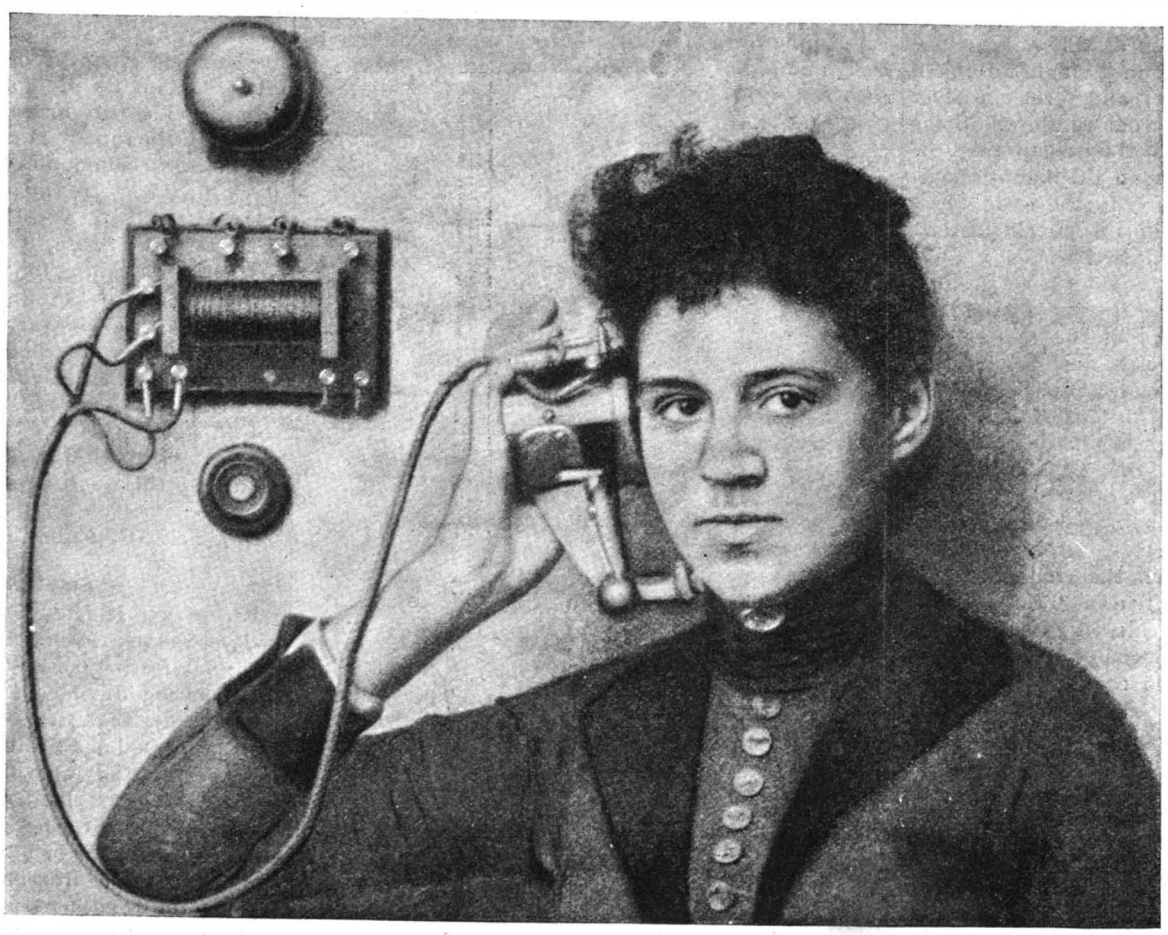


Fig. 10.—MAGNETIZATION BY LOADSTONE.



THE LOWTH TELEPHONE.

It is claimed that this new telephone is entirely distinct from what is usually called the Bell system, as the instrument employs no diaphragm, and is not operated by atmospheric or sound waves, but by the muscular vibrations that precede and also accompany the utterance of words and other sounds. These vibrations are imparted to the button which is held against the exterior surface of the throat, and conducted by proper mechanism connected therewith to the electrodes or current-controlling elements, thereby causing the distant receiver to reproduce the words or other sounds.

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Another valuable and peculiar feature of this instrument is that the operator may be surrounded by all manner of loud noises and only his voice will be transmitted, and then he may speak almost in a whisper. This is a very valuable quality, as city lines are generally troubled with induction, accidental disturbances on the diaphragms of transmitters of the common type furnishing their full share of the load. This new method shuts out all accidentals.

James Lowth, the inventor, was the first and has been the only experimenter in this field, and to his efforts and exhaustive experiments is due the present perfection of the system, which is now controlled by the Lowth Stetho-Telephone Company, of Chicago. This novel device will rank among the most curious and wonderful of inventions.

A GAS-PROPELLED CARRIAGE.

At the exhibition of machinery which was held in Munich during the past year, the attention of the visitor was attracted to a vehicle with a motor constructed by the Rhine Gas Motor Works, Benz & Co., of Mannheim. This motor is driven by gas which it generates from benzine or analogous material. As can be seen from the accompanying cut, this new vehicle is well shaped compared with others of the same class. The motor, which is not visible from the outside, is placed in the rear of the three-wheeled carriage over the main axle, and the benzine used in its propulsion is carried in a closed copper receptacle secured under the seat, from which it passes drop by drop to the generator, and which holds enough benzine for a journey of about 75 miles. The gas mixture is ignited in a closed cylinder by means of an electric spark—a very safe and reliable arrangement. After regulating the admission of the gas, the motor can be started by simply turning a hand lever. The operator climbs upon the seat and, by pressing the lever at his left, sets the motor into operation, and it starts the vehicle, being connected with the back wheels. The speed of the motor can be increased or diminished at will by turning the lever backward or forward, and it can be stopped by pulling on the lever. The vehicle is steered in the same manner as a tricycle, by a small front wheel. It can attain a speed of about ten miles an hour, but in crowded streets it can be made to move as slowly as an ordinary vehicle. A quart of benzine is sufficient for an hour's trip, making the cost of the motive power about seven cents per hour, and the experiments with the vehicle in the streets of Munich during the exhibition proved the practicability of substituting this kind of motive power for the more expensive horse power in many cases.—*Illustrirte Zeitung.*

A GAS-PROPELLED CARRIAGE.

A Crew Disabled by Lightning.

The Guion line steamer Alaska, from New York, which lately arrived at Queenstown, brings intelligence of the ship Edward, from Havre, with a cargo of iron ore, whose captain reported that the vessel encountered a terrible electrical storm in the Atlantic on the night of the 31st ult., when in latitude 41 42 N., longitude 54 42 W., lasting for several hours. The vessel was continuously enveloped in lightning, which prostrated on the deck eleven seamen, and deprived them of sight for nearly half a day. The second officer and the boatswain were also dashed to the deck, and received serious injury, and the former was speechless for five hours. Three balls of fire exploded with a tremendous report over the main rigging, scattering flaming fragments over the ship, and driving the remaining members of the crew in terror into the forecastle. From 3 A. M. until 7 P. M. the captain and mate were the only persons on board capable of doing any work, and on them devolved the task of keeping the vessel before the easterly gale. The captain states that all on board the ship were trembling with fear during the time that the electrical storm lasted, which was the most terrible he ever witnessed, and he adds that no doubt the iron ore with which the Edward was laden acted as a magnet to attract the lightning.

The Texan Tarantula and Its Foe.

Dr. Horn, Philadelphia's distinguished entomologist, writes to the *Ledger* the following:

"In the not too fertile parts of the region from Texas to California lives a large spider known to the inhabitants as the tarantula and to naturalists as Mygale Hentzii. Its body is two inches or more in length, clothed with rusty brown hair, the legs long, and when extended covering an oval of four by five inches. As may be imagined, the mygale is not a handsome insect, and while it is looked upon with terror by most people, no one cares to handle it unless quite certain it is dead.

"In place of the web which usually forms the house of spiders, the mygale excavates a burrow in the loose soil, from which it wanders in search of its prey, consisting principally of members of the grasshopper family, or Cicades. The jaws are large and powerful, armed with long, stout fangs, with which they can pierce and kill their prey. One full meal will at times supply their needs for several weeks. In fact, during the moulting period they remain torpid and take no food.

"During its growth the mygale makes an unknown number of moults, that is, it sheds its outer coat when that has become uncomfortably close fitting, in the same manner as the common crab of our coast. At these times members lost from the body by accidents are partially replaced. If a leg is lost, the first moult produces a perfectly formed but short leg, subsequent moults increasing the size of the leg.

"While the mygale is a dread to most forms of insect life, there is one of which it, in turn, stands in mortal terror. Abundant in the same regions is a large wasp, with bluish-green body and golden-red wings. The body is about two inches long, the spread of wings nearly an inch greater. These wasps (Pepsis formosa) fly uneasily about in search of food for themselves until they discover a 'tarantula,' when a more definite course of action is assumed. The flight of the wasp is now in circles around its prey, gradually approaching it, the mygale meanwhile, in terror, showing fight, standing semi-erect on the two hinder pair of legs. A favorable opportunity presenting, the wasp stings the spider and renews the circle flight, repeating the sting until the spider becomes completely paralyzed. When the wasp is assured of the helplessness of the spider, it seizes him and drags him to a previously prepared nest. The eggs of the wasp are then deposited and the spider covered up. The eggs soon hatch, the spider is gradually eaten, and a new wasp appears to repeat the actions of its parent.

"By the sting of the wasp the spider is not killed, simply paralyzed, so that during the time it is being fed upon it retains vitality, furnishing living food to the newly hatched larvæ, which, by a curious instinct, feed first on those parts of the spider not essential to the maintaining of the little vitality remaining.

"Our common mud wasp, Chalybion, has similar habits. Its nests, made of elastic mud, are familiar to most people, as they are found abundantly in sheltered places about barns and other outhouses. These, when opened, will be found filled with spiders in the helpless condition already mentioned, among them a larva and some partly eaten spiders."

The Population of Germany.

The results of the German census, taken on December 1, 1885, have been long known. But it is only in this month's number of the Statistical Record of the German Empire that the details are published. Total, 46,855,704.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Julius M. Farmer, New York City. A revolving disk secured to the main driving shaft carries sets of two cylinders each placed diametrically opposite each other, and connected by a piston rod carrying a crosshead held to slide on a fixed pin arranged eccentrically to the revolving disk, a steam chest being formed on the bearing of the disk and connected by ports with the sets of steam cylinders.

METALLIC RAILROAD TIE.—George W. Thompson, Sag Harbor, N. Y. This invention is an improvement on tubular metallic ties having bearing blocks within the rail-bearing portions, and provides for inserting the bearing blocks in the ends of the ties after the inner bolts have been applied, the heads of the bolts abutting against the sides of the blocks and holding them in position.

RAILWAY SPIKE.—Thomas A. Davies, New York City. This invention covers an improvement on a spike formerly patented by the same inventor, and provides means whereby the spike when driven will be guided diagonally of the tie, its bottom edge being formed to gather the wood fibers and cut them evenly and cleanly.

CUSHION FOR RAILROAD RAILS.—Thomas A. Davies, New York City. This is a hard metal plate having one face covered with soft metal, designed to be placed between the rail and tie, whereby the wear of the fish plates by the abutting ends of the rail sections will be avoided, and the loosening of the joints thereby prevented.

FLOOD GATE.—Jacob Erkmann, Enfield, Ill. It is made with two hinged gates, each provided with a roller and inclined ways therefor, a latch for locking the gate, the latch being provided with a float, the construction being such that the gates will open automatically as the water rises and close as it falls, while the gate is not liable to be opened by stock.

BOAT.—Franklin M. Smith, Leaper, Ohio. The hull is made of a waterproof endless web, with paddle sections upon the outside of the web, and endless chains with plates upon its inside, in connection with a pair of shafts with sprocket wheels, the hull itself supplying the means of flotation, while the web constituting its body revolves around the sprocket wheels like an endless belt to supply means of propulsion.

CHAIN PROPELLER.—Franklin M. Smith, Leaper, Ohio, In this propeller paddles are attached to endless chains passing around sprocket wheels, the paddles being braced and held in proper position to secure a hold upon the water, and also enabled to travel around the sprocket wheels with the least friction and cramping strains.

WELL SINKING MACHINE.—Chester A. Overton and Oscar E. Ingersoll, Bliss, Neb. This invention covers a specially constructed sliding support for the tubing of a drilling tool and a perforated pipe forming part of the boring tube and covered by a shell adapted to be cut and raised after the well is sunk to the proper depth, the device effectively furnishing water for the work of the drill.

UNLOADING CARS.—John Scully, South Amboy, N. J. This invention covers an improvement on a machine for such purposes formerly patented by the same inventor, whereby the shovels may be shifted sidewise upon a stationary supporting frame for carrying them to different positions in a car, and from one track to another.

Agricultural.

FERTILIZER APPARATUS.—Stephen V. Mills, Richfield, Pa. A receptacle containing chemical absorbents is connected by pipes with a trough located in the farmyard and a collecting box in the stable, for collecting the liquid manures and converting their valuable properties into drill fertilizers, while preventing overfermentation, etc., of the solid manure of the farmyard.

HOE.—John M. Hefner, Marietta, Texas. The hoe is formed with a curved neck, made broad or deep and thin, with a straight sharp cutting edge, thus forming an upper, thin, independent blade, capable of being filed or sharpened, and making the implement a practically double-bladed one, the cutting edges of the two blades being in crosswise relation with each other.

Miscellaneous.

BREECH-LOADING FIREARM. — Elmore A. Harris, Norwich, Conn. The barrels of this firearm are placed one above the other, there being two rifled barrels, or two shot barrels, or one of each, a trunnion extending from each side of the web connecting the barrels, these trunnions resting in horizontal slots formed in side plates of the stock, while there is a novel arrangement of extractors and firing pins.

PROJECTILE.—Hugo Bischoff, Berlin, and Armand Mieg, Leipsic, Saxony, Germany. The projectile is made of a hard metal casing containing lead or similar material, while a guide ring of soft metal is forced into the hard metal casing, to guide the projectile through the barrel without injuring its grooves.

POUNCING FELT.—Henry G. Wolcott, Matteawan, N. Y. This invention consists in a rapidly revolving flap-like beater for pouncing or finishing irregular shaped articles of felt, by subjecting them while on their lasts to the action of the beater, the flaps or surfaces of which are of a granulated, cutting, and abrading character.

STENCILING MACHINE.—John A. C. Hamill, Racine, Wis. It is for stenciling a pattern on a continuous web, the machine consisting of a perforated cylinder held over a fixed table over which passes the web to be stenciled, while a brush is held in contact with the inside of the cylinder to brush a color or other substance through the perforations.

JUTE STRIPPING MACHINE.—William Menzies, Paterson, N. J. The machine comprises a set of crushing rollers for breaking the butts of the stalks, a revolving drum and a draw frame working in an opening thereof for drawing the crushed butts and the butt fibers down into the inside of the drum, the principal part of the fiber being stripped by the revolution of the drum and wrapped around its outer surface, the machine having various other novel features and being also designed for stripping other fibrous plants.

BUTTON MACHINE.—Clyde J. Coleman, of Gideon, Kansas. This is a machine for threading staple fasteners to buttons and passing the fastener-threaded buttons to a shuttle, which, when filled, will be adjusted to another machine, which secures the buttons by the fasteners to the vamps of boots or shoes or other articles, the machine working automatically.

SASH BALANCE.—James H. Jenkins, Thomasville, Ga. This invention covers a novel method of balancing one sash by the other, dispensing with box frames, cords, weights, and pulleys, and whereby the upper sash may be held at various points of suspension for ventilating purposes.

Business and Personal.

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NEW BOOKS AND PUBLICATIONS.

CHEMICAL LECTURE NOTES. By Peter T. Austen, Ph.D., F.C.S., Professor of General and Applied Chemistry, Rutgers College, and the New Jersey State Scientific School. John Wiley & Sons, New York, 1888. Pp 98. Price $1.

In this admirable little work the general subject of chemistry is most graphically treated, and what is ordinarily considered a very dry branch of science is, by the distinguished author, made vivid and interesting. The powers and extent of the science, rather than its limitations, are dwelt upon, and in the text a prophetic view of what chemistry will yet achieve is included. A reproduction of the table of contents will show how completely the subject is covered, and it gives some idea of the condensation to which the matter has been subjected. The book is one for both student and professor, and representatives of both classes may be certain that they will find much new matter in it.

MODERN HELIOGRAPHIC PROCESSES. Manual of Instructions in the Art of Reproducing Drawings, Engravings, Manuscripts, etc., by the Action of Light. Thirty-two illustrations on wood and ten specimen heliograms. By Ernst Lietze, M.E. D. Van Nostrand Company, New York, 1888. Pp. viii, 143. Price $3.

This work is pre-eminently a practical one. After a short treatise on the theory of the subject and classification of the processes, the practical portion of the work begins. The qualities of paper, methods of sensitizing, apparatus and its use, and the question of exposure are all treated of. Then the different processes are treated, including those with silver, iron salts, and chromium and uranium salts. A very practical table giving commercial and scientific factors of photographic chemicals and a copious index add to the volume of the book. The specimens of heliograms produced by different methods are very interesting. The other illustrations show typical apparatus of the advance type.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(61) C. W. W. asks: Is it the custom in the building of high chimneys, say one of 250 feet, to make the flue larger at the top than at the bottom? If so, please state reason. A. Chimneys have been built with a slight inside taper, smaller or larger at top. They are the exception. Parallel or straight on the inside is the general and best practice.

(62) P. W. G. writes: Referring to your issue of October 13, 1888, article on alum baking powders: 1. Is the formula given in avoirdupois or druggists' weight? A. The grain is the same in all systems. The ounce alluded to is the apothecary's or troy ounce of 480 grains. 2. And what is the meaning of the characters thus, ʒ iij, at the right of the bicarbonate of soda ounces? A. The characters read, "three drachms."

(63) J. S. S. writes: In your issue of October 6, 1888, an article entitled "Manufacture of Light without Heat" says: "The means adopted was the oscillatory discharge of a Leyden jar, whose rate of vibration has been made as high as 1,000 million complete vibrations per second." 1. Is it possible to count as high as 1,000 million complete vibrations per second? If so, with what machinery can it be done? A. The "counting" is not done mechanically, the velocity and number of waves and their length are deduced from experimental observation coupled with mathematical deduction. As a parallel case, consult any good book on physics and see how the number of light waves per second is determined. 2. Can light be produced without heat? If it can, please give an instance. A. Probably not. It never has been hitherto.

(64) A. H. G. writes: 1. What do professional singers use to clear the throat before commencing to sing? Or what is the best known remedy for this purpose? A. Chlorate of potash or common salt may be dissolved in water and used as a gargle. It is far better to use nothing. A person whose throat troubles him when singing probably sings incorrectly, not using the abdominal muscles properly. 2. What should be eaten the last meal before singing? A. Different singers follow different customs. A good meal about two hours before singing is a common sense rule. Apples are considered good, also raw or soft boiled eggs.

(65) E. W. C. writes: 1. Would it be more advisable for a student of mechanical drawing to study books or go into an office? A. You should first study and then try to get a position in an office. 2. If to study books, what to study, and where to get them, estimated cost, etc.? A. We can supply you with many excellent works by mail. We name a few. "Mechanical Drawing Self-Taught," by Joshua Rose, $4.00. MacCord's "Easy Lessons in Mechanical Drawing," $2.50 and $3.50. "Mechanical Drawing" prepared for the use of students of the Mass. Institute of Technology, by Faunce, $1.25. 3. Are there schools where mechanical drawing is a specialty? A. Mechanical drawing is taught in all of the principal colleges and in many public and private schools all through the United States. Mechanical drawing alone is hardly enough to be called a specialty.

(66) E. A. D. asks: 1. How many standard sixteen candle power (Edison) lamps may be used on the dynamo described in SUPPLEMENT 600? A. The dynamo will run six or eight lamps. 2. Give the measurements by which the machine, if not sufficiently powerful, may be increased in power to use sixteen standard lamps on it? A. Make it one quarter larger in all its lineal dimensions and use one size larger wire. 3. Have you any book on electric lighting? If so, give price. A. We recommend and can supply you with Thompson's "Dynamo Electric Machinery. Price $5. Herring's 'Principles of Dynamo Electric Machines." Price $2.50. Also Atkinson's "Treatise on Electric Lighting." Price $1.50. These are all recent works. 4. Is there an explosive called extralite, a later invention than bellite? A. For bellite we refer you to SCIENTIFIC AMERICAN, vol. 56, Nos. 17, 20, and 22. We have no information concerning extralite.

(67) B. R. W. asks the cause of polarization and rapid running down of all forms of the sal-ammoniac batteries. A. The reaction is usually expressed as follows: $Zn+2NH_4Cl=ZnCl_2+2NH_3+2H$. The hydrogen goes to the carbon electrode or prism and quickly polarizes the battery. The porous cup in the Leclanche couple is filled with binoxide of manganese and graphite. The former is reduced by the hydrogen, and thus prevents polarization. The reaction is as follows: $2MnO_2+2H=H_2O+M_2O_3$. Where no depolarizer is used the large surface of the carbon is relied on to prevent too quick polarization, when the depolarization is due to the escape of the hydrogen.

(68) R. E. S. asks (1) if a U-shaped tube, with one arm twice the diameter of the other, is half filled with mercury, and the pressure of the atmosphere is removed by placing the tube in vacuum, will the weight of the mercury in the larger arm raise the mercury in the smaller arm, or will it retain its level? A. The mercury will retain its level in both tubes entirely irrespective of atmospheric pressure. 2. Is there any substance which is a conductor of electricity, that cannot be destroyed by fire (except metal)? A. No: graphite is destroyed by fire only with great difficulty, and is a conductor, though not a good one.

(69) C. F. G. asks: Could any one get a good knowledge of law by studying at leisure time? What law books would be necessary, and where could he get such books? A. Study without court and office practice would be a very imperfect way of learning law. We can supply you with the books free by mail at regular prices. Blackstone's "Commentaries" is the first book to read. This we can supply for $7.50.

(70) A. B. asks: When it is 12 o'clock noon at Washington what will be the time at other places? A. Ascertain longitude of other places, then for every 15 degrees west of Washington subtract one hour and for every 15 degrees east add same. For every 4 minutes longitude allow one minute time, and for every 4 seconds longitude allow one second.

(71) D. J. W. asks what process cast iron goes through, to give it the appearance of oxidized brass. A. A bronzed surface may be produced on clean iron surfaces or articles by exposing to the vapors of a heated mixture of equal parts of hydrochloric and nitric acids for a few minutes, and then heating the articles to about 600° Fah., to continue until the desired color appears. The objects are then to be cooled and rubbed with vaseline and heated until the latter begins to decompose. If not deep enough in color, repeat the last operation. A bronze colored oxide coating is also obtained by adding acetic acid to the above mixture, with variations in depth of color by varying the proportions of the acids. For the method of applying the "Tucker bronze" so much used on cast iron trimmings, see SCIENTIFIC AMERICAN of August 9, 1884, page 84. Also see "Techno-Chemical Receipt Book" for a variety of receipts for bronzing, browning, and blacking iron and other metals, which we can mail for $2.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(72) Will you please inform me through the SCIENTIFIC AMERICAN if there is a spring, fountain, or lake where petrifying is done? And if there is such a place, where is it? And how long will it take to petrify a cubic inch?—K. C.

(73) Will you kindly inform me the electrical horse power and internal resistance of an accumulator whose capacity is 2 volts and 125 ampere hours? The rule? What is the resistance of an incandescent lamp, 16 candle power, 110 volts, six-tenths of an ampere? Is there not a difference in the resistance of an incandescent lamp hot and cold? I have a small arc light dynamo of five lamps capacity in my store. Can I charge a set of storage batteries with it while it is supplying current for the lamps? If so, how must I connect them? What instruments must I use, if any?—C. W. F.

(74) I write to ask you if you can give me a little idea as to best way and method, together with the formulas for making bromide prints. I have long sought a good method for so doing, but have never succeeded with them to any satisfaction.—E. A. B.

(75) Please let me know what metals to use and what size strips, and how to put together to make a regulator bar for an egg drawer to an incubator to hatch eggs. Want to set it so that it will work from 100° to 103°, and if heat gets more, so that it will work valves open and turn check burner to lamp. Let me know particularly in regard to making bar, etc.—L. M. C.

(76) Will you inform me through your columns whether there is a relief valve made that will take off back pressure when exhaust is used to heat dry kilns with? Also whether a smaller sized pipe can be used in the kiln than the exhaust pipe from engine, without creating back pressure. How near should fire wall in furnace be to shell of boiler, and whether it should be curved on top or straight?—F. R.

(77) Will you kindly inform a reader of your paper, of a way to recover silver from waste paper and filtering cottons? Also how to take a negative, to use for an etching print direct from a photograph, without drawing.—G. A. T.

(78) Please give me a receipt or method for making gas burn red. I wish to use the receipt for our Christmas tree festivities.—D. A. R.

(79) Can we run a 30 h. p. engine, eight hundred feet from boiler, with 3 in. pipe, by burying it in sawdust or earth, and what pressure should we have on boiler to get 30 h. p. from a 12 by 18 engine? Give us any further information regarding the above that you can.—K. & W.

(80) We have lately erected an iron smoke stack which stands 10 or 15 feet higher than any of the surrounding buildings. Should any precautions be taken to protect it from lightning or to prevent it causing discharges dangerous to the attached and surrounding buildings?—G. A. S.

(81) 1. Is there any way of preventing patent leather from cracking? 2. Is there any way of closing the cracks if the leather is already cracked? 3. In intimately mixing dry powdered niter (6 parts by weight), sulphur (2 parts) tersulphuret of antimony (1 part), is there any danger of an explosion?—S. P. P.

(82) Would you please answer and explain the correct answer to the following problem? Does it require any more power to raise a weight from the ground by means of a rope while standing on a platform 30 feet high than it requires when you are on the ground close to it, provided the total weight raised and all other conditions remain the same in both cases?—J. C.

(83) We have had a discussion as to who invented the telephone. Please inform us as to who did invent it.—C. D. M.

(84) What is a wheel used by lapidaries for cutting hard stone or metals made of, and how is it used?—F. E. W.

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(85) Our dwelling has an exposed wall which is damp inside, especially in rainy weather. It is covered with a coat of roughcasting (mortar), but does not seem to have the desired effect. Will you inform me of a remedy for this dampness, excluding wood?—A. J. C.

(86) Will you kindly inform me the method and machinery used in preparing the wood for the manufacture of matches, and wood best adapted for the purpose?—M. C. H.

(87) We have a hot water heating apparatus in our establishment. Any time in cold weather when fire is rushed we can turn air cock on a radiator and obtain a gas, igniting and burning with the characteristic hydrogen flame. The boiler manufactures this water gas whenever there is a good hot fire. May not steam boilers manufacture this same gas, and would that not be one of the reasons of the many unaccountable explosions?—F. S. W.

(88) I have nearly completed an electric motor one-half size of one you described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Will you please inform me how many volts electromotive force will be required to operate it?—J. M. A.

(89) The size iron wire to use on an induction coil 6 inches in length, also the size copper wire and how many coils each way. Is a No. 2 Grenet battery sufficient to operate a coil of that size?—W. S. P.

(90) How is granite iron or tin ware made, that is, how is the color and gloss put on, and can other colors, such as red, blue, or white, be put on in the same way? And is there a patent on making such wares?—T. G. A.

(91) I have some galvanized wire netting nailed on frames on which I dry glue. The galvanizing has worn off and the wire rusted, and I want to find some solution with which to cover the wire to keep rust off the glue. Can you give it to me? Of course I could have it regalvanized, but the expense of taking wire off frames and nailing on again is too much.—W. H. B.

(92) Can I work 25 gallons silver solution with 3 cells of Wollaston batteries containing 4 gallons each, zincs to be 6 by 18 inches? Copper plates the same size. How can I produce a bluish black on brass that will be durable? I have seen some that was copper plated, and that was blacked, especially on smoke jacks of lamps in cars. Is it absolutely necessary to quick articles of brass or copper before placing them in bath, in order to produce good results?—S. B. R.

(93) 1. What is the first thing that moves on the locomotive, the valve or the piston, after the steam is admitted, that is, after the throttle is opened? 2. What moves first, the crossheads or the engine (locomotive)? 3. Place the engine on the back dead center, right side, with the reversing lever down in the corner (forward motion), now reverse the lever to the extreme back motion (but do not move the engine), is the valve on the right side in the same position as it was before she was reversed?—A. M. S.

(94) 1. I have a telephone line about ¼ of a mile, of No. 30 hard phosphor bronze wire. Will you tell us if that size wire (phosphor bronze) will carry current enough from battery, or the magneto call bell, to ring a bell at that distance? 2. How many cells, say the largest, of Dr. Gassner's dry battery will it require to instantly heat a No. 30 platinum wire to white heat? —C. B. H.

(95) How many, and what, are the constant movements of the ocean's waters?—S. P. E.

(96) What is the horse power of 200 gallons of water per minute over a 25 ft. fall, and what would the same be of a 50 ft. fall?—L. M. M.

(97) Please inform me which side of a belt is proper to turn next to a pulley—the smooth side or rough?—A.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(1) In issue of December 22, (1) G. W. asks for a recipe for hardening soles of shoes. If a pair of new shoes has the soles made warm by holding them near a fire or stove, and then varnishing them with copal varnish, drying them, warming, and applying a second and third coat, the leather will become waterproof, and very hard, lasting about twice as long as if not thus treated.—D. P.

(15) Speed of House Fly.—The maximum rate of speed in flight of the common house fly (*Musca domestica*) is 53·35 meters per second.—R. B.

(32) Preventing Condensation of Moisture on Tin Roofs.—A tin roof should have placed under the tin a layer of shoddy sheathing paper, such as is used to make into tarred felt, but without the tar. This will prevent the condensation of moisture upon the lower side of the tin. The tin should be thoroughly painted upon both sides with Prince's metallic paint and linseed oil, half boiled and half raw. More tin roofs are destroyed by condensed moisture upon the lower, unpainted side of the tin than in any other way.

(32) To Prevent Dripping Ceiling.—Use tarred paper between tin and ceiling boards. This will tend to overcome the dripping by preventing too great chilling of the upper layer of air. Ventilation from the highest point of the roof will also alleviate the trouble. —X.

(32) J. A. B.—Preventing Moisture on Roofs.—Yes. Anything that will prevent the contact of the moist inside air with the cold tin. Tarred roofing paper is the best. If not attainable, hardware or carpet paper will answer the purpose.

(33) Lacquering Brass.—Caustic soda lye will loosen lacquer. The articles to be lacquered must be warm and perfectly clean. A finger touch will mar the work. Use alcoholic solution of shellac.

(33) About Lacquers.—Clean the brass work of instruments by boiling in caustic soda water, if convenient, otherwise soak in alcohol and wipe. For aluminum lacquer, dissolve bleached shellac in the best, or 95 per cent alcohol. Heat all work to about 212° before lacquering, use a broad camel's hair brush, work quickly and place the work in a hot oven or over a spirit lamp for a few minutes, to glaze the surface of the lacquer. To deaden the gloss on instrument work: Clean perfectly free from grease with soda water, rinse, and dip in a bath of nitric acid 1 part, water 4 parts, for from 2 to 5 seconds; rinse off the acid in hot water, dip again in hot soda water and in hot clean water to leave the surface perfectly from acid. Dry in sawdust. Color lacquers with dragon's blood and saffron to the required depth.

(34) Rules for Size of Wire for Given Current, etc.—1. There are several such rules founded on the heating of the wire. The English Board of Trade rule allows 1,000 amperes per 1 square inch sectional area. Of course this is well within the safe limit, and is often exceeded in practice. 2. The wire on a line should be as large as possible, as its resistance consumes energy. The armature of a dynamo requires a considerable number of turns of wire to give electromotive force at reasonable speed of rotation, and cannot well be made of large enough dimensions to use heavy wire. 3. Practical rules are obtained for the different types of machines. A true theoretical rule is yet a desideratum. 4. Yes.

(35) Circular Saw Practice.—You cannot work a saw from the shaft of your engine, as the speed is insufficient. You do not give enough particulars forrest of query to be intelligently answered.—Sawmill.

(35) X. L., Boilers and Belts.—If you carry 60 lb. pressure in your boiler and can run the engine at 150 revolutions per minute, you can make your saw available only by belting, so as to give it 1,000 revolutions per minute. At the above pressure and speed the engine should indicate 30 h. p. If your boiler is large enough, it will furnish steam for this power. You give us no data to compute the boiler power. It should have 300 square feet of heating surface to stand up fairly with the above speed. If you can run your saw at the above speed with the saw in good order, you should turn out 12,000 feet of pine lumber per day of 10 hours, or in proportion for less speed.

(36) In answer to R. D., No. 36, in your issue of December 15, we would say that we have a cell of the "gelatine battery" manufactured by the H. B. Cox Electric Company, of New Haven Conn., which has been ringing a bell in our office ever since September 6, and has not stopped yet—a total of 106 days. And it seems to vibrate as strongly now as any time in the past 60 days.—G. S. A.

(36) Bronzing Steel.—Expose cleansed objects to vapor of a heated mixture of concentrated hydrochloric and nitric acid for a few minutes and then heat to 572° to 662° F. until bronze color appears. Cool rub with vaseline and heat until latter is decomposed, and repeat process if necessary. Heating polished steel will develop the blue color.

(36) Bronzing and Bluing.—Steel spectacle frames are blued by placing them, polished and perfectly clean, in a muffle or oven heated to exactly the temperature necessary to bring out the exact color, which is between 500° and 600° F. The frames are laid on little racks, so that the heat will strike every part alike. The workmen watch for the color. When obtained, the rack is withdrawn and cooled in a cold air blast. The bronze frames are plated with a very thin coating of brass and heated in the same way as for bluing, but at a less temperature. A bronze color is also obtained by a higher polish on the steel and heating to a straw color, about 350° to 400°.

(37) Leather Tanning without Bark.—In 1877 Knapp patented a process for using iron salts. It is described in Davis' manufacture of leather.

(38) Your jars are very small for your purposes. Use a zinc plate well amalgamated and a carbon plate about ½ inch from the zinc. Excite with electropoion fluid (bichromate potash, sulphuric acid, and water). For each candle power you would need two or three such cups, and they would soon be exhausted.—Electric.

(39) Copying Writing without Blotting. —You may use too much water. The secret of success consists in using just the right amount.

(40) Luminous Paint.—It is best to buy it ready made. The SCIENTIFIC AMERICAN SUPPLEMENT, No. 249, describes the manufacture.—P. P.

(41) Burning Stumps, and Maple Sirup. —Bore holes in stumps and fill with kerosene or nitrate of soda and water. After long standing ignite them.—Filter maple sirup through bone-black to improve color. Before boiling filter through cotton drilling.—M. M.

(42) Coloring Gas Tar.—No powder is known that will color gas tar.—Gas Engineer.

(43) Sighting Rifles.—The sights are adjusted by the maker to cause their line and the axis of the barrel prolonged to intersect, as nearly as possible, at the different ranges for which the back sight is calibrated. Your question implies too broad an assertion, as with fixed sights no such fact obtains except at a single range. Even with the finest sighted pieces it is doubtful if such a requirement is practically applied.—Creedmore.

(43) Gun Sights.—The trajectory of the bullet makes an arched curve on the vertical plane of the sights. The sights are set to meet the curve at a certain distance, and are not parallel with the bore. Thus the setting of the sights for a 100 yard target are lower at the breech than for a 200 yard target. The distance of the front sight from the center of the barrel has no connection with the adjustment of the aim.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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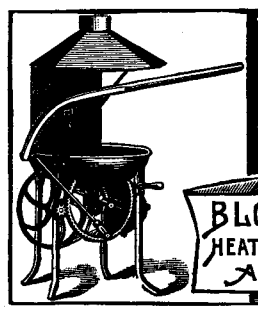

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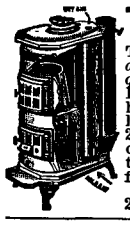

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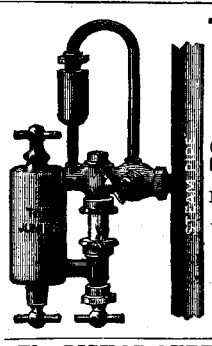

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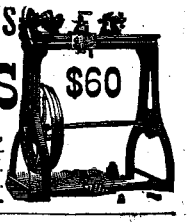

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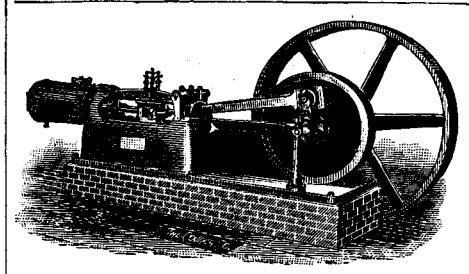

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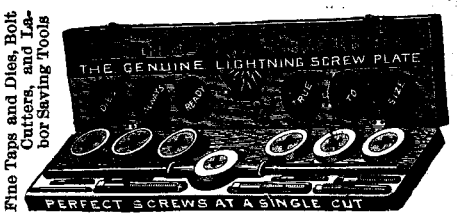

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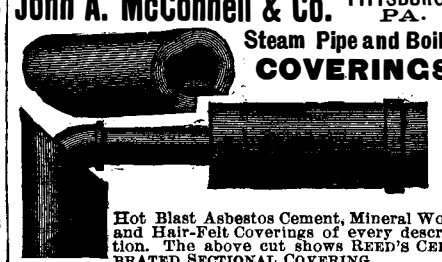

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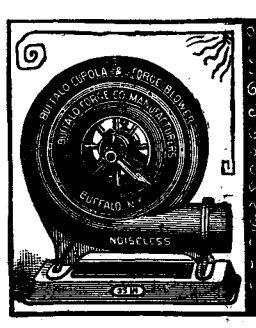

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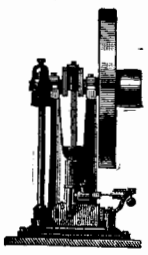
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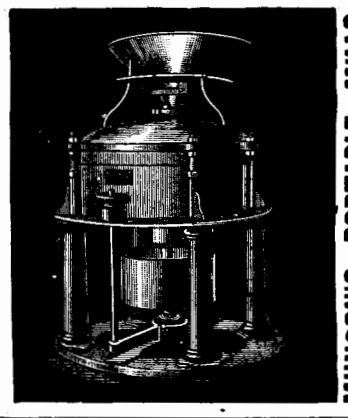
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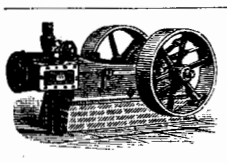
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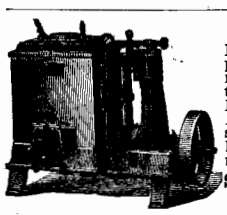
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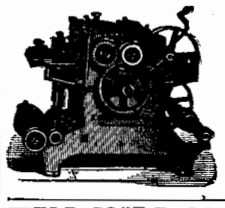
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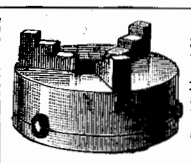
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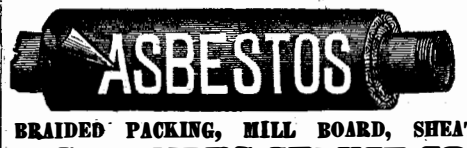

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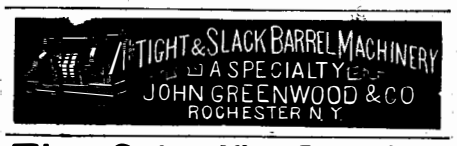

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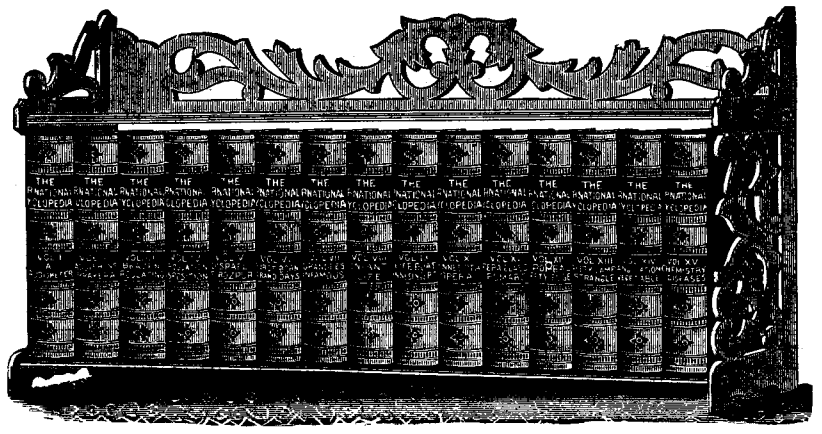

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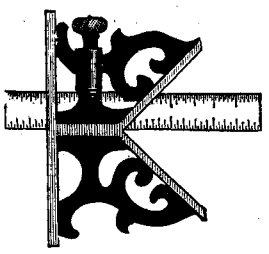

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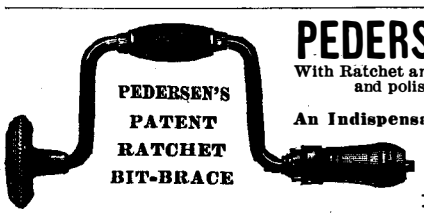

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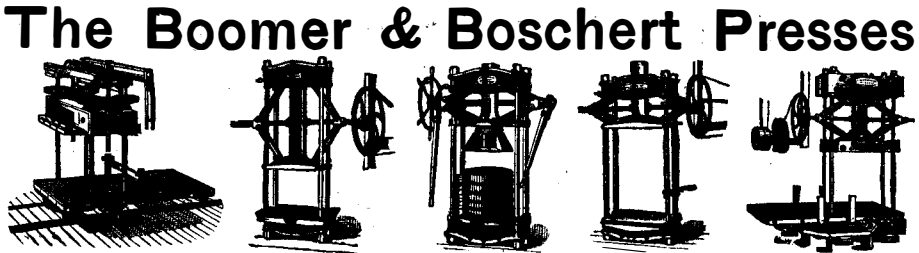

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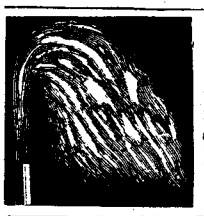

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